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THE ANNALS  
AND  
MAGAZINE OF NATURAL HISTORY,  
INCLUDING  
ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND  
CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY  
WILLIAM CARRUTHERS, Ph.D., F.R.S., F.L.S., F.G.S.,  
ARTHUR E. SHIPLEY, M.A., Sc.D., F.R.S., F.Z.S.,  
AND  
WILLIAM FRANCIS, F.L.S.

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VOL. X.—EIGHTH SERIES.  
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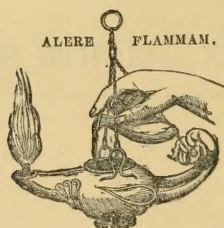
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"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exulta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

. . . . . The sylvan powers  
Obey our summons; from their deepest dells  
The Dryads come, and throw their garlands wild  
And odorous branches at our feet; the Nymphs  
That press with nimble step the mountain-thyme  
And purple heath-flower come not empty-handed,  
But scatter round ten thousand forms minute  
Of velvet moss or lichen, torn from rock  
Or rifted oak or cavern deep: the Naiads too  
Quit their loved native stream, from whose smooth face  
They crop the lily, and each sedge and rush  
That drinks the rippling tide: the frozen poles,  
Where peril waits the bold adventurer's tread,  
The burning sands of Borneo and Cayenne,  
All, all to us unlock their secret stores  
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.





# CONTENTS OF VOL. X.

[EIGHTH SERIES.]

## NUMBER 55.

	Page
I. Descriptions of new Species of <i>Pyralidæ</i> of the Subfamily <i>Pyraustinae</i> . By Sir GEORGE F. HAMPSON, Bart., F.Z.S., &c. ....	1
II. Descriptions and Records of Bees.—XLV. By T. D. A. COCKERELL, University of Colorado .....	21
III. Preliminary Descriptions of Eleven new Crinoids belonging to the Families <i>Himerometridæ</i> , <i>Mariametridæ</i> , and <i>Colobometridæ</i> , discovered by the 'Siboga' in the Dutch East Indies. By AUSTIN H. CLARK .....	31
IV. Mammals from the Ja River, Cameroons. By OLDFIELD THOMAS .....	41
V. Small Mammals from South America. By OLDFIELD THOMAS. ....	44
VI. Notes on Fossorial Hymenoptera.—XI. By ROWLAND E. TURNER, F.Z.S., F.E.S. ....	48
VII. Descriptions of new Harvest-men of the Family <i>Phalangodidæ</i> . By STANLEY HIRST. (Plate I.) .....	63
VIII. <i>Hersilia</i> ( <i>Cluusidium</i> ) <i>vancouverensis</i> . By KATHLEEN HADDON. (Plate II.) .....	84
IX. Descriptions of Ethiopian Rhynchota (Heteroptera). By W. L. DISTANT .....	87
X. A Discussion of the General Classification of the Pelecypoda. By M. COLLEY MARCH, M.Sc., Geological Department, Manchester University. (Plate III.) .....	91
XI. Notes from the Gatty Marine Laboratory, St. Andrews.—No. XXXIII. By Prof. M'INTOSH, M.D., LL.D., F.R.S., &c. (Plates IV. & V.) .....	117
XII. A new Elephant Shrew from the Island of Zanzibar. By GUY DOLLMAN .....	130

	Page
XIII. On a new Palm-Civet from Timor. By ERNST SCHWARZ.	131
XIV. On a Terrestrial Amphipod from Kew Gardens. By W. T. CALMAN, D.Sc. ....	132
XV. Descriptions of Three new African Cichlid Fishes of the Genus <i>Tilapia</i> , preserved in the British Museum. By G. A. BOULENGER, F.R.S. ....	138
XVI. Descriptions of new African Batrachians preserved in the British Museum. By G. A. BOULENGER, F.R.S. ....	140
XVII. A Revision of the <i>Asilidæ</i> of Australasia. By GERTRUDE RICARDO ....	142
<i>New Books</i> :—A Revision of the <i>Ichneumonidæ</i> , based on the Collection in the British Museum (Natural History), with Descriptions of new Genera and Species. Part I. Tribes Ophonides and Metopiides. By CLAUDE MORLEY, F.Z.S., F.E.S.—Records of the Indian Museum. (A Journal of Indian Zoology.) Vol. iv. no. x. Annotated Catalogue of Oriental <i>Culicidæ</i> . Supplement. By E. BRUNETTI ....	160, 161
Proceedings of the Geological Society .....	161, 162
Editorial Note.....	164

## NUMBER 56.

XVIII. Report on the Annelida Polychæta collected in the North Sea and adjacent parts by the Scotch Fishery Board Vessel 'Goldseeker.'—Part I. <i>Amphinomidæ</i> to <i>Sigalionidæ</i> . By WILLIAM SMALL, M.A., B.Sc., Gatty Marine Laboratory, St. Andrews. (Plate VI.) .....	165
XIX. Descriptions of new Batrachians from the Andes of South America, preserved in the British Museum. By G. A. BOULENGER, F.R.S. ....	185
XX. New or little-known Ethiopian Hemiptera. By E. BERGROTH, C.M.Z.S. ....	191
XXI. <i>Lygistorrhina urichi</i> , a new Mycetophilid from Trinidad. By F. W. EDWARDS, B.A., F.E.S. ....	203
XXII. A new Vespertilionine Bat from Angola. By OLDFIELD THOMAS .....	204
XXIII. On a Species of <i>Nymphon</i> from the North Pacific. By FLORA M. SCOTT, M.A., University College, Dundee. (Plate VII.)	206
XXIV. A Revision of the South-American Siluroid Fishes of the Genus <i>Corydoras</i> , with a List of the Specimens in the British Museum (Natural History). By C. TATE REGAN, M.A. ....	209

	Page
XXV. Some Considerations in regard to the Classification of the Order Thysanoptera. By RICHARD S. BAGNALL, F.L.S., F.E.S., Hope Department of Zoology, University Museum, Oxford .....	220
XXVI. Entomological Notes from the London School of Tropical Medicine.—No. IV. Blood-sucking Diptera from Port Darwin, Australia. By SOPHIA L. M. SUMMERS, M.A., B.Sc., Carnegie Student of Aberdeen University .....	222
XXVII. Two new Species of <i>Nasua</i> . By OLDFIELD THOMAS ..	228
XXVIII. Description of a new Desert-Lark from the Central Western Sahara. By ERNST HARTERT .....	230
XXIX. New Species of Heterocera from Costa Rica.—XVII. By W. SCHAUS, F.Z.S. ....	231
XXX. A new Species of <i>Tabanus</i> from German East Africa, in the British Museum (Natural History). By ERNEST E. AUSTEN ..	240
XXXI. On a new Species of <i>Oligoneuria</i> ( <i>Ephemeridæ</i> ) from British East Africa. By Rev. A. E. EATON.....	243
XXXII. Some new Species of <i>Ipidæ</i> and <i>Platypodidæ</i> in the British Museum. By Lt.-Col. WINN SAMPSON, F.E.S. ....	245
XXXIII. On new Species of <i>Histeridæ</i> and Notices of others. By G. LEWIS, F.L.S. ....	250
XXXIV. Notes on Guiana Birds. By LORD BRABOURNE, F.Z.S., M.B.O.U., and CHARLES CHUBB, F.Z.S., M.B.O.U., Zoological Department, British Museum .....	261
XXXV. Description of a new Cichlid Fish from the Lower Niger. By G. A. BOULENGER, F.Z.S. ....	263
<i>New Book</i> :—Memoirs of the Department of Agriculture in India. Entomological Series. Vol. IV. No. 1. Eri Silk. By H. MAXWELL-LEFROY and C. C. GHOSH, Agricultural Research Institute, Pusa .....	ib.
A Review of South-African Land-Mollusca belonging to the Family <i>Zonitidæ</i> , by Lt.-Col. H. H. Godwin-Austen, F.R.S. &c.; Errata in Dr. Ärnäck-Christie-Linde's paper in the 'Annals' for June 1912 .....	264

## NUMBER 57.

XXXVI. The Classification of the Blennioid Fishes. By C. TATE REGAN, M.A. ....	265
XXXVII. Two new West-African Mammals. By OLDFIELD THOMAS .....	280
XXXVIII. Self-evisceration in the Asteroidea. By NATHANIEL COLGAN, M.R.I.A. ....	282
XXXIX. New Species of Heterocera from Costa Rica.—XVII. By W. SCHAUS, F.Z.S. ....	286

	Page
XL. Descriptions and Records of Bees.—XLVI. By T. D. A. COCKERELL, University of Colorado .....	311
XLI. Three new Species of Neotropical <i>Coccinellidæ</i> . By GUY A. K. MARSHALL .....	320
XLII. Description of Two new Eels from West Africa, belonging to a new Genus and Family. By C. TATE BEGAN, M.A. ....	323
XLIII. Notes on Malay Tigers, with Description of a new Form from Bali. By ERNST SCHWARZ .....	324
XLIV. Descriptions of some new Burmese Species of Ruteline Coleoptera belonging to the Genus <i>Anomala</i> . By GILBERT J. ARROW .....	327
XLV. On the Stromatoporoids and <i>Eozoon</i> . By R. KIRKPATRICK. (Plates VIII. & IX.) .....	341
XLVI. The Anatomy and Classification of the Teleostean Fishes of the Order Lyomeri. By C. TATE REGAN, M.A. ....	347
XLVII. A Revision of the <i>Asilidæ</i> of Australasia. By GERTRUDE RICARDO .....	350

## NUMBER 58.

XLVIII. Notes on Fossorial Hymenoptera.—X. By ROWLAND E. TURNER, F.Z.S., F.E.S. ....	361
XLIX. The Osteology and Classification of the Teleostean Fishes of the Order Apodes. By C. TATE REGAN, M.A. ....	377
L. A Revision of the South-American Characid Fishes of the Genera <i>Chalceus</i> , <i>Pyrrhulina</i> , <i>Copeina</i> , and <i>Pogonocharax</i> . By C. TATE REGAN, M.A. ....	387
LI. On a Collection of Small Mammals from the Tsin-ling Mountains, Central China, presented by Mr. G. Fenwick Owen to the National Museum. By OLDFIELD THOMAS .....	395
LII. New Bats and Rodents from S. America. By OLDFIELD THOMAS .....	403
LIII. New Land and Freshwater Shells collected by Dr. J. Elbert in the Malay Archipelago. By Dr. F. HAAS, Frankfurt-a.-M. ....	412
LIV. Descriptions of new Reptiles from the Andes of South America, preserved in the British Museum. By G. A. BOULENGER, F.R.S. ....	420
LV. A Contribution to the Knowledge of the Fauna of <i>Bromeliaceæ</i> . By HUGH SCOTT, M.A. (Cantab.), F.L.S., F.E.S., Curator in Entomology in the University of Cambridge. Including Descriptions of new Insects by W. L. DISTANT, F.E.S., and the late R. SHELFORD, M.A., F.L.S. (Plate X.) .....	424
LVI. Descriptions of some new Homoptera. By W. L. DISTANT. ....	438
LVII. On the Structure of Stromatoporoids and of <i>Eozoon</i> . By R. KIRKPATRICK. (Plates XI. & XII.) .....	446
<i>New Book</i> :—Recent Foreign and Colonial Natural History Periodicals .....	460



## NUMBER 59.

	Page
LVIII. Notes on the <i>Apidae</i> (Hymenoptera) in the Collection of the British Museum, with Descriptions of new Species. By GEOFFREY MEADE-WALDO, M.A. ....	461
LIX. Observations on living Gorgonias ( <i>Gorgonia verrucosa</i> ) occurring in the English Channel. By J. STUART THOMSON, Ph.D., F.L.S., F.R.S.E., Lecturer and Senior Demonstrator in Zoology, Victoria University of Manchester .....	479
LX. Descriptions and Records of Bees.—XLVII. By T. D. A. COCKERELL, University of Colorado .....	484
LXI. A Revision of the Poeciliid Fishes of the Genera <i>Rivulus</i> , <i>Pterolebias</i> , and <i>Cynolebias</i> . By C. TATE REGAN, M.A. ....	494
LXII. New Species of Heterocera from Costa Rica.—XVIII. By W. SCHAUS, F.Z.S. ....	509
LXIII. Notes on Fossorial Hymenoptera.—XI. By ROWLAND E. TURNER, F.Z.S., F.E.S. ....	533
LXIV. Brief Diagnoses of Eight new <i>Petalia</i> , with a List of the known forms of the Genus. By KNUD ANDERSEN .....	546
LXV. On Specimens of <i>Cephalodiscus nigrescens</i> supposed to have been dredged in 1841 or 1842. By W. G. RIDEWOOD.....	550

*New Books*:—Recent Foreign and Colonial Natural History Periodicals.—Records of the Western Australian Museum and Art Gallery. Edited by the Director, BERNARD H. WOODWARD. Vol. I. Part 2.—Distribution and Origin of Life in America. By ROBERT FRANCIS SCHARFF, Ph.D., B.Sc. 555, 556

## NUMBER 60.

LXVI. Descriptions of new Species of <i>Pyralidæ</i> of the Subfamily <i>Pyraustineæ</i> . By Sir GEORGE F. HAMPSON, Bart., F.Z.S., &c. ....	557
LXVII. On some Reptilian Lower Jaws. By D. M. S. WATSON, M.Sc. ....	573
LXVIII. Two new Races of Mongoose. By OLDFIELD THOMAS. ....	588
LXIX. On new Mammals from the Islands of the Johore Archipelago, South China Sea. By HERBERT C. ROBINSON, C.M.Z.S. ..	589
LXX. Eight new Fishes from Baluchistan. By Dr. ERICH ZUGMAYER, of the Zoological Museum, Munich .....	595
LXXI. <i>Apherusa jurinei</i> (M.-Edw.). By ALFRED O. WALKER, F.L.S., F.Z.S. ....	600
LXXII. Descriptions of Two new Fishes from the Nile System. By G. A. BOULENGER, F.R.S. ....	601
LXXIII. Rhynchotal Notes. By W. L. DISTANT .....	602



	Page
LXXIV. Descriptions of new African <i>Agaristidæ</i> in the British Museum. By Sir GEORGE F. HAMPSON, Bart.....	609
LXXV. Two new Mongooses from Somaliland. By R. E. DRAKE-BROCKMAN, M.R.C.S., L.R.C.P., F.Z.S. ....	612
LXXVI. On the Development of the Pectoral Girdle in the Pipefish ( <i>Syngnathus acus</i> ). By T. P. BUIST, M.A., B.Sc., Gatty Marine Laboratory, University of St. Andrews. (Plate XIII.) ....	613
LXXVII. Notes on some New Zealand <i>Pselaphidæ</i> in the British Museum, with Descriptions of new Species of the Genus <i>Sagola</i> . By Major T. BROWN, F.E.S. ....	621
LXXVIII. The Anatomy and Classification of the Teleostean Fishes of the Order Discocephali. By C. TATE REGAN, M.A. ....	634
LXXIX. The <i>Curistiidæ</i> , a Family of Berycomorphous Fishes. By C. TATE REGAN, M.A. ....	637
LXXX. New <i>Centronycteris</i> and <i>Ctenomys</i> from S. America. By OLDFIELD THOMAS ....	638
LXXXI. A new <i>Cynopterus</i> from Borneo. By KNUD ANDERSEN. ....	640
LXXXII. Sexual Differences in the Péciliid Fishes of the Genus <i>Cynolebias</i> . By C. TATE REGAN, M.A. ....	641
Index .....	643

---

#### PLATES IN VOL. X.

- PLATE I. New Harvest-men of the family Phalangodidæ.  
 II. *Hersilia* (*Clausidium*) *vancouverensis*, *K. Haddon*.  
 III. Classification of the Pelecypoda.  
 IV. White Porpoise.  
 V. *Eteone depressa* and *Dasybranchus caducus*.  
 VI. Annelida Polychæta from the North Sea.  
 VII. Nymphon *pixellæ*, *F. M. Scott*.  
 VIII. {  
 IX. { Stromatoporoids and Eozoon.  
 X. Fauna of Bromeliaceæ.  
 XI. {  
 XII. { Stromatoporoids and Eozoon.  
 XIII. Pectoral girdle in the Pipefish.

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[EIGHTH SERIES.]

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"..... per litora spargite muscum,  
Naiades, et circum vitreos considite fontes:  
Pollice virgineo teneros hic carpite flores:  
Floribus et pictum, divæ, replete canistrum.  
At vos, o Nymphæ Craterides, ite sub undas;  
Ite, recurvato variata corallia trunco  
Vellite muscosis e rupibus, et mihi conchas  
Ferte, Deæ pelagi, et pingui conchylia succo."  
*N. Parthenii Giannettasi, Ecl. 1.*

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No. 55. JULY 1912.

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I.—*Descriptions of new Species of Pyralidæ of the Subfamily Pyraustinae.* By Sir GEORGE F. HAMPSON, Bart., F.Z.S. &c.

[Continued from vol. ix. p. 633.]

(4 a) *Goniorhynchus lasyguialis*, sp. n.

Fore tibiæ of male tufted with long hair on inner side, the first joint of tarsus curved and fringed with long hair on inner side; fore wing with slight depressed grooves in cell.

♂. Head, thorax, and abdomen reddish brown; pectus, base of legs, and ventral surface of abdomen whitish. Fore wing glossy ochreous brown suffused with fuscous; traces of a dark antemedial line; an obscure dark discoidal spot; postmedial line dark, rather strongly dentate, excurved from costa to vein 4, then oblique; a terminal series of black points; cilia greyish ochreous at base followed by a fine dark line. Hind wing brown with a cupreous gloss; a terminal series of black points; cilia greyish ochreous at base followed by a dark line; the underside greyer, an obscure discoidal spot and indistinct maculate postmedial line defined by greyish on outer side.

*Hab.* PARAGUAY, Sapucay (*Foster*), 1 ♂ type. *Exp.* 28 mm  
*Ann. & Mag. N. Hist. Ser. 3. Vol. x.* 1



*(7 a) Goniorhynchus octosema*, sp. n.

♂. Head and thorax yellow; palpi black, white at base; lower part of frons black; shoulders with brown stripes; tibiae with blackish bands at extremities; abdomen yellow, a black band on third segment, the terminal segments tinged with red-brown, the anal tuft black above and with a black bar before it below. Fore wing golden yellow; the costal area black-brown from near base to end of cell, expanding into a triangular antemedial patch, a small round spot in upper part of middle of cell and confluent with a figure-of-eight-shaped discoidal patch, its centre slightly tinged with grey; antemedial line fine, brown, from cell to inner margin; postmedial line brown, excurved below costa and between veins 5 and 2, then retracted to below the discoidal patch and sinuous to inner margin; a terminal black-brown line expanding somewhat at apex; cilia black-brown with a fine pale line at base. Hind wing golden yellow; a brown discoidal point; postmedial line brown, bent outwards between veins 5 and 2, then retracted to below end of cell and oblique to above tornus; a terminal black-brown line except towards tornus; cilia black-brown with fine white lines at base and middle.

*Hab.* SINGAPORE (Ridley), 1 ♂ type. *Exp.* 22 mm.

*(7 b) Goniorhynchus marginalis*, sp. n.

♀. Head and thorax yellowish tinged with brown; palpi black-brown, white at base; frons and antennae black-brown; fore tibiae black-brown; abdomen yellowish white with pair of dorsal brown points on second segment. Fore wing pale yellow, the costal area suffused with brown, the terminal area deep cupreous brown, widening towards costa; a small brown spot at middle of cell conjoined to the costal area and with a faint line from it to inner margin; a triangular brown discoidal patch conjoined to the costal area; postmedial line indistinct, nearly straight from costa to vein 2, then retracted to just below angle of cell and erect to inner margin. Hind wing pale yellow; a slight discoidal point; postmedial line indistinct, excurved between veins 5 and 2; a terminal cupreous-brown band narrowing to a point at tornus.

*Hab.* PERU, La Merced (Watkins & Tomlinson), 1 ♀ type. *Exp.* 24 mm.

*(1 a) Piletosoma holophæalis*, sp. n.

Antennae of male thickened by a ridge of scales at base;



hind tibiæ fringed with very long hair above, with a tuft of long hair from base below followed by a thick fringe of hair, the medial spurs absent, the terminal outer spur very long, the first joint of tarsus fringed with very long hair below.

Head, thorax, and abdomen dark brown; pectus and base of legs whitish; ventral surface of abdomen white, fuscous towards extremity, the anal tuft and claspers white below, genital tufts ochreous white. Wings uniform dark brown tinged with purplish, a slight pale line at base of cilia.

*Hab.* SINGAPORE (*Ridley*), 1 ♂, 1 ♀ type; BORNEO, Sandakan (*Pryer*), 2 ♀. *Exp.* 28 mm.

(3 a) *Botyodes brachytorna*, sp. n.

Hind wing of male with the termen indented at submedian fold, the tornal area contorted and thickly clothed with rough hair above and below.

♂. Head and thorax orange-yellow; palpi with black points at sides of joints; antennæ ringed with black towards base; tegulæ, shoulders, and patagia with black spots; fore coxæ with black spots, the femora and tibiæ at extremities with black bands, the fore tarsi ringed with black; abdomen yellow, the second segment with subdorsal black spots, the terminal segments with silvery rings and the anal tuft silvery, the ventral surface dark brown at extremity. Fore wing yellow; a subbasal black spot below costa; small antemedial black spots below costa and cell and above inner margin; a silvery discoidal bar defined by brown; the terminal area red-brown with a leaden gloss and defined on inner side by a dark brown line which is sinuous to vein 4, then angled inwards to the discoidal bar and again sinuous to inner margin; a dark brown subterminal shade, a terminal series of black striæ, and fine pale line at base of cilia. Hind wing yellow, the terminal area broadly red-brown with a silvery leaden gloss and defined on inner side by a dark brown line; a dark subterminal shade and black terminal line.

♀. Hind wing without the silvery gloss on termen and at tornus, the terminal line broken up into black striæ, a dark line near base of cilia.

*Hab.* BR. N. GUINEA, Ekeikei (*Pratt*), 3 ♂, 1 ♀ type, Mt. Kebea (*Pratt*), 1 ♂, 2 ♀, Mafalu (*Pratt*), 1 ♀. *Exp.* 30-32 mm.

(4 c) *Sylepta monoleuca*, sp. n.

Antennæ of male with the tooth on basal joint large, the shaft thickened just beyond it; fore wing on underside

with fringes of scales and hair at upper and lower angles of cell.

♂. Head and thorax black-brown, the antennæ whitish towards tips, the tarsi whitish; abdomen fuscous black, the ventral surface white. Fore wing uniform black-brown with a cupreous tinge. Hind wing black-brown with a cupreous tinge; a rather quadrate white spot beyond lower angle of cell.

*Hab.* DUTCH N. GUINEA, Fak-fak (*Pratt*), 1 ♂ type. *Exp.* 28 mm.

(12 a) *Sylepta microspilalis*, sp. n.

♂. Head, thorax, and abdomen ochreous tinged with brown; palpi white at base; pectus and ventral surface of abdomen white. Fore wing ochreous tinged with brown, the costal and terminal areas rather darker; two dark antemedial points in cell and one below the cell with an oblique line from it to inner margin; a small yellowish discoidal lunule defined by fuscous; postmedial line dark, minutely dentate and oblique from costa to vein 2, then retracted to below angle of cell and oblique to inner margin with a dark point at submedian fold; cilia fuscous. Hind wing pale ochreous, the apical area tinged with fuscous; a slight postmedial line bent outwards and minutely dentate between veins 5 and 2.

*Hab.* SINGAPORE (*Ridley*), 2 ♂ type. *Exp.* 24 mm.

(18 a) *Sylepta albirivalis*, sp. n.

♀. Head, thorax, and abdomen cupreous brown, the vertex of head whitish; abdomen with slight whitish segmental lines; palpi at base, pectus, legs, and ventral surface of abdomen white. Fore wing cupreous brown; an indistinct oblique whitish antemedial line slightly defined on outer side by fuscous; a small white spot in middle of cell and discoidal bar defined by fuscous; a postmedial white line arising below costa, its outer edge very slightly waved to vein 5, where it is very slightly bent outwards, at vein 2 bent inwards to below end of cell, then slightly excurved. Hind wing cupreous brown; a slight whitish discoidal lunule defined by fuscous; postmedial line white faintly defined on inner side by fuscous, very slightly bent outwards at vein 5, at vein 2 bent inwards and almost obsolete to below end of cell, then oblique to above tornus; cilia whitish with a dark line through them; the underside greyer.

*Hab.* DUTCH N. GUINEA, Kapaur (*Doherty*), 1 ♀ type. *Exp.* 28 mm.

(20 c) *Sylepta parvipuncta*, sp. n.

Head, thorax, and abdomen fuscous brown with a greyish tinge; palpi black, white at base; pectus, legs, and ventral surface of abdomen white, the fore tibiæ with blackish band. Fore wing fuscous brown with a cupreous gloss; antemedial line indistinct, whitish defined on outer side by blackish, somewhat oblique from costa to submedian fold; small black spots at middle of cell and on discocellulars, the latter with faint whitish marks before and beyond it; postmedial line whitish defined on inner side by blackish, forming a tridentate white mark from below costa to vein 5, then excurved to vein 2, then bent inwards to below base of cell and more distinct and excurved to inner margin. Hind wing fuscous brown with a cupreous gloss; a blackish discoidal spot; postmedial line whitish defined on inner side by blackish, bent outwards between veins 5 and 2, then inwards to below angle of cell and oblique to above tornus; cilia with a fine whitish line at base and whitish tips; the underside whitish with the terminal area suffused with fuscous, the discoidal lunule and postmedial line more distinct.

*Hab.* SIERRA LEONE (*Clements*), 1 ♂ type; GOLD COAST, Kumasi (*Whiteside*), 1 ♀. *Exp.* 24–26 mm.

(22 a) *Sylepta leucographalis*, sp. n.

♂. Head and thorax fuscous mixed with greyish; palpi black, greyish at base and tips; pectus and legs whitish, the fore tibiæ fuscous at extremities; abdomen with the basal half grey with fuscous lines, the terminal half fuscous with grey segmental lines, the ventral surface whitish. Fore wing fuscous brown suffused with purple; an antemedial white spot in cell and whitish band from cell to inner margin; quadrate black spots in middle of cell and on discocellulars with a quadrate white spot between them and smaller spot below the cell; postmedial line fuscous, incurved and with quadrifid yellowish white patch beyond it from costa to vein 5, bent outwards and slightly defined by white between veins 5 and 2, then retracted to lower angle of cell and excurved to inner margin, with yellowish white spot beyond it in submedian interspace and small spot above inner margin; cilia yellowish white from vein 3 to tornus. Hind wing yellowish white; some diffused fuscous below base of cell; an oblique fuscous band from upper angle of cell to above tornus; a small dark lunule beyond the cell; the terminal area fuscous suffused with purple, a postmedial line between veins 5 and 2 slightly

defined by whitish on outer side and retracted at vein 2 ; cilia white at submedian interspace.

*Hab.* BALI (*Doherty*), 1 ♂ type. *Exp.* 30 mm.

(32 b) *Sylepta tumidipes*, sp. n.

Mid femora of male greatly dilated.

♂. Head, thorax, and abdomen white tinged with ochreous, the vertex of head, tegulæ, and patagia with some brown ; fore tibiæ with fuscous band ; abdomen with blackish bands on second and penultimate segments and subdorsal streaks on anal segment. Fore wing white tinged with ochreous ; a curved black subbasal line from costa to vein 1, followed by a blackish shade from below costa to inner margin ; a strong curved black-brown antemedial line, conjoined at median nervure to an oblique bar in middle of cell ; a pale discoidal bar on a black-brown patch extending to costa ; postmedial line strong, black-brown, incurved from costa to vein 5, excurved to vein 2, then bent inwards to the lower edge of the discoidal patch and oblique to inner margin near the antemedial line ; a terminal black-brown band, broad and with curved inner edge from costa to vein 4, then narrow to vein 2 and expanding into a large patch on tornal area confluent with the curve of postmedial line ; cilia brownish with a white line at base and whitish patch above tornus. Hind wing white tinged with ochreous ; a black discoidal spot with oblique line from it to above inner margin towards tornus ; postmedial line blackish, bent outwards between veins 5 and 2 where it terminates ; a blackish terminal line expanding into patches at apex and in submedian interspace ; cilia with a slight brownish line through them.

Ab. 1. Head and thorax yellower with much more black-brown ; abdomen yellower banded dorsally with black-brown and almost wholly black-brown towards extremity ; wings yellower with the dark areas more extensive and tinged with purple ; fore wing with the whole terminal area dark except a bar from costa and small spot below vein 2 ; hind wing with the whole terminal area dark except a slight pale line beyond the postmedial line towards costa and the excurved medial part.

*Hab.* SIERRA LEONE (*Clements*), 2 ♂ type ; GOLD COAST, Kumasi (*Whiteside*), 1 ♂ ; S. NIGERIA, Sapele (*Sampson*), 2 ♂. *Exp.* 26-28 mm.

(35 a) *Sylepta microdentalis*, sp. n.

♂. Pale grey-brown : pectus, legs, and ventral surface of



abdomen whitish, the fringe of hair on hind tibiæ red-brown on inner side. Fore wing with faint pale point in cell and spot below it before the very indistinct antemedial line; a small pale spot in end of cell before the slight dark discoidal lunule with pale centre; postmedial line indistinct, dark, slightly bent outwards between veins 5 and 3 with two small dentate white marks before it, then retracted to below end of cell and erect to inner margin; the costa pale before and just beyond it. Hind wing with indistinct dark discoidal spot followed by a faint pale bar before the postmedial line, which is very indistinct and diffused, forming a spot beyond lower angle of cell, then retracted to lower angle and oblique to inner margin beyond middle; cilia with brown line near base and whitish tips; the underside whitish.

♀. Fore wing rather browner; the point in cell and spot below it more distinct; no spot before the discoidal lunule, the lower extremity of which is connected with three small dentate pale marks in sinus of postmedial line, costa not pale; hind wing with the pale spot beyond the cell more distinct, the postmedial line excurved at median nervules, not forming a spot.

*Hab.* VENEZUELA, 1 ♂; FR. GUIANA, Cayenne (*Schaus*), 1 ♂ type, Maroni R. (*Schaus*), type ♀ in Coll. *Schaus*. *Exp.*, ♂ 30, ♀ 28 mm. These may possibly be different species.

(38 a) *Sylepta leucinalis*, sp. n.

♀. Head whitish suffused with cupreous brown; palpi with blackish bands at extremities of first and second joints; thorax white slightly tinged with brown, the tegulæ with fuscous patches at middle; the fore tibiæ with blackish band; abdomen white with dorsal black band on third segment, the terminal segments slightly tinged with brown. Fore wing white slightly irrorated with brown; a black point at base of costa, slight subbasal striga from costa and point above inner margin; antemedial line slight, dark, excurved from below costa to inner margin; small dark annuli in and below middle of cell; an oblique black discoidal bar with white point in its upper part and some brown suffusion below it; postmedial line double, dentate, oblique from costa to vein 3, at vein 2 bent inwards to below end of cell and angled outwards above vein 1, the area beyond it suffused with brown from apex to vein 4 and towards tornus; a terminal series of blackish striæ; cilia with dark line through them and dark points at tips. Hind wing white slightly irrorated with brown; two



slight dark discoidal points and brownish shades below and beyond end of cell ; postmedial line double, dentate, with a dark spot on the inner line at discal fold, incurved at submedian fold ; the apex with brown patch ; a terminal series of blackish striae and a brown line through the cilia.

*Hab.* E. PERU, Pozuzo, 2 ♀ type. *Exp.* 30 mm.

(40 a) \**Sylepta desmialis*, sp. n.

Hind tibiae of male with very thick tufts of hair on upper side.

♂. Fuscous ; palpi at base, pectus, and ventral surface of abdomen white ; legs black and white. Fore wing with subbasal hyaline point in cell ; quadrate antemedial spots in cell, the latter with a similar spot below it ; a lunulate mark just beyond the cell composed of five almost conjoined spots between veins 3 and 8, the two middle ones larger. Hind wing with oblique dark medial line ending above tornus ; a quadrate discoidal hyaline spot with a short dark line on its outer edge ; cilia of both wings with a fine white line at base.

*Hab.* S. NIGERIA, Lagos (*Boag*), 1 ♂, Sapele (*F. W. Sampson*), 3 ♂ type. *Exp.* 24 mm.

(40 c) *Sylepta melanomma*, sp. n.

♀. Head and thorax ochreous white mixed with dark brown ; palpi white with blackish bands at middle and extremity ; pectus and legs ochreous white, the fore tibiae with fuscous band at extremity ; abdomen ochreous white banded with brown, the terminal segment with blackish patch, the ventral surface white. Fore wing ochreous white ; somewhat oblique blackish subbasal and antemedial bands, the latter confluent with a spot on its outer side below the cell ; somewhat quadrate blackish spots in end of cell and on discocellulars, confluent on median nervure, and a band from lower angle of cell to inner margin ; the terminal area broadly blackish with a cupreous gloss, an ochreous-white postmedial bar on it from costa to vein 6 ; cilia whitish. Hind wing ochreous white ; a faint diffused dark subbasal band ; a blackish discoidal spot ; a dark postmedial band, oblique to vein 3, then bent inwards to lower angle of cell and oblique to above tornus ; terminal area blackish with a cupreous gloss, joined at vein 2 by a spur from postmedial band and with an ochreous-white sub-

terminal band on it from vein 4 to near tornus ; cilia white at base, dark at tips.

*Hab.* S. NIGERIA, Ilesha (*Humphrey*), 2 ♀ type. *Exp.* 26-28 mm.

(44 a) *Sylepta xylocrasis*, sp. n.

♀. Head, thorax, and abdomen fulvous yellow tinged with red-brown ; palpi whitish at base ; pectus and ventral surface of abdomen white. Fore wing orange-yellow, the costa tinged with fulvous, a broad terminal red-brown band ; an indistinct curved brown antemedial line ; a small brown spot in middle of cell and larger discoidal spot ; postmedial line brown, strong and obliquely incurved from costa to the terminal band at vein 5, at vein 2 retracted to below end of cell and erect to inner margin. Hind wing orange-yellow with a broad brown terminal band ; an oblique brown discoidal striga ; postmedial line brown, rather strong, ex-curved between veins 5 and 2 ; the underside with the terminal band narrower.

*Hab.* NATAL, Durban (*Innes*), 2 ♀ type. *Exp.* 32-34 mm.

(50 b) *Sylepta holophæalis*, sp. n.

♂. Head, thorax, and abdomen dark reddish brown ; palpi white at base, black towards tips ; pectus, greater part of legs, and ventral surface of abdomen whitish ; genital tufts ochreous. Fore wing brown with a cupreous gloss ; traces of a dark antemedial line, a slight dark discoidal lunule ; an indistinct dark postmedial line slightly bent outwards between veins 5 and 2, then retracted to lower angle of cell and erect to inner margin. Hind wing brown with a cupreous gloss ; a faint dark postmedial line, slightly ex-curved between veins 5 and 2, then retracted to lower angle of cell and oblique to tornus.

*Hab.* PARAGUAY, Sapucay (*Foster*), 1 ♂ type. *Exp.* 28 mm.

(50 c) *Sylepta semilugens*, sp. n.

♂. Head, thorax, and abdomen fulvous yellow ; palpi whitish at base ; pectus and legs whitish, the fore femora at extremity and tibiae above brownish. Fore wing with the basal area fulvous yellow with subbasal black spot on inner margin ; a medial pale yellow band with the costal area fulvous and a slight brownish point in middle of cell ; the terminal half pale brownish with faint dark discoidal bar

and some yellowish on costa beyond middle. Hind wing with the basal half pale yellow, the terminal half pale brownish. Underside of fore wing with slight fuscous discoidal spot and diffused brownish postmedial band, bent inwards below vein 2; hind wing with slight black subbasal spot in upper part of cell and diffused brownish postmedial band.

*Hab.* W. AFRICA, Cameroons (*Sjostedt*), 1 ♂ type. *Exp.* 42 mm.

(50 d) *Sylepta acidental**is*, sp. n.

♂. Yellow; pectus, legs, and ventral surface of abdomen whitish; fore tibiae banded with brown, mid tibiae streaked with brown. Fore wing with curved, somewhat waved and diffused antemedial line from subcostal nervure to inner margin; a dark point in middle of cell and discoidal lunule; postmedial line strongly and rather irregularly dentate, oblique, bent outwards between veins 5 and 2 and with diffused dentate band across its sinus. Hind wing with oblique diffused somewhat dentate band from costa beyond middle to tornus, towards which it narrows and with dentate line beyond it between veins 5 and 2; the apical part of costal area suffused with brown.

*Hab.* S.W. NEW GUINEA, Kapaur (*Doherty*), 1 ♂ type. *Exp.* 32 mm.

(51 c) *Sylepta retracta**lis*, sp. n.

♂. Head, thorax, and abdomen pale yellow, the neck with fulvous ring, the abdomen with faint fulvous-yellow segmental bands; palpi white at base, fulvous at tips; pectus, legs, and ventral surface of abdomen white, the fore tibiae yellowish. Fore wing pale yellow, the costa and veins tinged with fulvous; antemedial line fuscous, oblique; a fuscous discoidal bar; postmedial line fuscous, slightly bent outwards between veins 5 and 2, then retracted to lower angle of cell, and oblique to inner margin near antemedial line; a fuscous terminal line and a fine line through the cilia which are whitish at tips. Hind wing pale yellow; a fuscous discoidal spot; postmedial line fuscous, bent outwards between veins 5 and 2, then retracted to lower angle of cell and oblique to above tornus; a fuscous terminal line and a line through the cilia which are whitish at tips.

*Hab.* GOLD COAST, Kumasi (*Whiteside*), 2 ♂ type. *Exp.* 24 mm.

(52 a) *Sylepta heliochroa*, sp. n.

♂. Head, thorax, and abdomen very pale yellow; pectus, legs, and ventral surface of abdomen white, the fore legs faintly tinged with brown. Fore wing very pale yellow, the costa whitish, the termen with faint dark shade expanding at apex. Hind wing very pale yellow.

♀. Abdomen dorsally fulvous except at base; fore wing without trace of the terminal shade.

*Hab.* BR. N. GUINEA, Dinawa (*Pratt*), 2 ♂, 2 ♀ type.  
*Exp.* 30 mm.

(52 b) *Sylepta tetrathyralis*, sp. n.

♂. Head, thorax, and abdomen orange-yellow; palpi with the third joint black; maxillary palpi black above; pectus and ventral surface of abdomen whitish. Fore wing orange-yellow, the medial area suffused with fulvous except the costal area and inner margin; the costal edge black; a hyaline spot from middle of cell to above vein 1 connected with a hyaline point beyond it in cell; a yellow point at upper angle of cell and a hyaline spot beyond lower angle between veins 5 and 2; an indistinct diffused waved subterminal line, incurved from vein 6 to below 5. Hind wing orange-yellow; some fulvous suffusion on basal inner area; a small dark brown mark on median nervure near base followed by a hyaline patch from middle of cell to submedian fold, then a fulvous-brown patch extending to beyond cell with a hyaline spot on it beyond lower angle, somewhat constricted at middle; an indistinct, rather diffused, waved fulvous subterminal line.

*Hab.* S.W. NEW GUINEA, Kapaur (*Doherty*), 1 ♂ type.  
*Exp.* 26 mm.

(59 a) *Sylepta attenualis*, sp. n.

Head and thorax pale ochreous tinged with brown; abdomen pale ochreous dorsally tinged with brown and with paired subdorsal black points on third segment, in male very elongate and attenuated; wings thinly scaled. Fore wing elongate and produced at apex; pale ochreous irrorated with brown especially on costal area to postmedial line; a subbasal black spot on inner margin; an oblique sinuous fuscous antemedial line; a black point in middle of cell and discoidal bar; postmedial line fuscous, bent outwards below veins 5 and 2, then retracted to below angle of cell and oblique to inner margin; a punctiform black terminal line; cilia whitish



tinged with fuscous. Hind wing pale ochreous irrorated with brown especially on disk; a slight fuscous discoidal bar; postmedial line fuscous, bent outwards between veins 5 and 2, then retracted and oblique to above tornus; a fine black terminal line, reduced to points in female; cilia whitish with a slight fuscous line near base.

*Hab.* BR. E. AFRICA, Lagari (*Belton*), 1 ♂ type, Ndimu (*Belton*), 1 ♀, Uganda Ry. Mile 478 (*Belton*), 1 ♀, E. Quaso (*Belton*), 1 ♂, 1 ♀. *Exp.*, ♂ 40, ♀ 34 mm.

(60 a) *Sylepta glaucalis*, sp. n.

Head, thorax, and abdomen grey-brown tinged with olive; palpi fuscous, white at base; pectus, legs, and ventral surface of abdomen whitish; fore tibiae and tarsi banded with fuscous. Fore wing grey-brown tinged with olive; a slight waved dark antemedial line; an indistinct dark point in middle of cell and discoidal lunule; postmedial line minutely dentate, bent outwards between veins 6 and 2, then retracted to below angle of cell; a slight dark terminal line and line at base of cilia. Hind wing grey-brown tinged with olive; a slight oblique dark discoidal striga; postmedial line bent outwards and minutely dentate between veins 5 and 2, then retracted to lower angle of cell and sinuous to tornus; a fine dark terminal line and line at base of cilia.

*Hab.* VENEZUELA, Palma Sol, 1 ♂; PARAGUAY, Sapucay (*Foster*), 14 ♂, 1 ♀ type. *Exp.* 28-30 mm.

(70 a) *Sylepta glaucosia*, sp. n.

*Sathria cephalis*, Druce, Biol. Centr.-Am., Het. ii. p. 242 (part.).

Head, thorax, and abdomen fulvous brown mixed with whitish, the last with the medial segments darker and with slight white segmental lines, the ventral surface white. Fore wing pale glaucous grey, the costa white with a fulvous streak below it; a fuscous subbasal shade from cell to inner margin followed by a whitish band; a quadrate semihyaline white spot just beyond the discocellulars. Hind wing pale glaucous grey with the basal area semihyaline white; cilia white.

*Hab.* MEXICO, Presidio (*Forrer*), 1 ♀; GUATEMALA, Zapote (*Champion*), 1 ♂, Godman-Salvin Coll.; PANAMA, La Chorrera (*Dolby-Tyler*), 1 ♂ type. *Exp.* 28-32 mm.

(71 a) *Sylepta diacymalis*, sp. n.

*Epicorsia butyrosa*, Druce, Biol. Centr.-Am., Het. ii. p. 212 (part.), nec Butl.

Head, thorax, and abdomen ochreous yellow mixed with



white; palpi black, white in front except at tips; shoulders with black bars with some fulvous above; fore tibiæ banded with black. Fore wing white tinged with ochreous yellow and faintly irrorated with grey, the costa pure white, except at base which is fulvous; a faint oblique grey antemedial line; a slight white discoidal striga; postmedial line indistinct, grey, oblique from vein 8 to discal fold, bent outwards from vein 5 to below 3, then retracted to below angle of cell and oblique and sinuous to inner margin. Hind wing white faintly tinged with ochreous and irrorated with grey; a faint grey discoidal striga; postmedial line indistinct, grey, bent outwards between veins 5 and 2, then retracted to below end of cell and again excurved.

*Hab.* MEXICO, Cuernavaca (*H. H. Smith*), 1 ♂ type; GUATEMALA, San Gerónimo (*Champion*), 1 ♀, Guatemala City (*Rodriguez*), 1 ♀; COSTA RICA, Candelaria Mts. (*Underwood*), 1 ♂, Irazu (*Rogers*), 1 ♂; PANAMA, Chiriqui (*Champion*), 2 ♀, Godman-Salvin Coll. *Exp.* 40-48 mm.

(73 a) *Sylepta phæophlebalis*, sp. n.

♂. White; palpi, tegulæ, and prothorax tinged with orange; fore tibiæ and tarsi tinged with fuscous. Fore wing with rather diffused brown streaks on the veins, stronger on subcostal and median nervures and veins 8, 7, 4, 1. Hind wing with faint brown streaks on median nervure and veins 5 to 1. Underside of fore wing with the costal area and termen tinged with fuscous, a slight discoidal bar; hind wing with the termen narrowly fuscous.

*Hab.* PERT, Rio Colorado (*Watkins & Tomlinson*), 1 ♂ type. *Exp.* 34 mm.

(75 b) *Sylepta atrisquamalis*, sp. n.

♀. Head, thorax, and abdomen yellowish white; palpi with black band at base of second joint and streak above; frons with black bar above; fore legs black in front except the tarsi. Fore wing yellowish white; small spots formed of aggregated black scales beyond lower angle of cell below veins 5, 4, 3. Hind wing yellowish white with an irroration of large black scales in, beyond, and below end of cell.

*Hab.* GERM. E. AFRICA, Bueni (*Neave*), 1 ♀ type. *Exp.* 32 mm.

(76 b) *Sylepta brunnescens*, sp. n.

*Hedypleta terricolalis*, Druce, Biol. Centr.-Am., Het. ii. p. 269 (part.), nec Möschl.

♀. Head, thorax, and abdomen pale reddish brown; palpi

brown, whitish at base; pectus, mid and hind legs, and ventral surface of abdomen white. Fore wing pale reddish brown, the inner half rather paler; traces of a sinuous antemedial line; a faint dark spot in middle of cell and discoidal lunule; postmedial line indistinct, slightly curved from costa to vein 2, then retracted to lower angle of cell and again excurved; a fine pale line at base of cilia followed by a dark line. Hind wing pale reddish brown, the basal and inner areas whitish; a slight dark discoidal bar; postmedial line indistinct, dark, slightly sinuous from costa to vein 2, then obsolete; a fine pale line at base of cilia followed by a dark line; the underside with the postmedial line slightly bent inwards at vein 2 and continued to inner margin.

*Hab.* MEXICO, Vera Cruz, Atoyac (*H. H. Smith*), 1 ♀, Godman-Salvin Coll.; BRAZIL, Rio Janeiro, 1 ♀ type. *Exp.* 30 mm.

(86 a) *Sylepta prorogata*, sp. n.

Head, thorax, and abdomen creamy white; palpi with blackish bands at extremities of first and second joints; tegulae brownish at base; fore tibiae with fuscous band; abdomen with subdorsal fuscous points on second segment, faint brownish segmental lines, subdorsal black points on penultimate segment and bar on terminal segment, the extremity tinged with orange. Fore wing ochreous white; basal blackish spots on costa and below cell; a subbasal black striga from costa and point below the cell, with fuscous points beyond them in and below the cell; antemedial line blackish with spot at costa, oblique to median nervure; two sinuous bars at middle of cell and two at discocellulars; the veins beyond the cell streaked with blackish; postmedial line slightly waved, angled outwards at vein 5, oblique to vein 2, then excurved, a curved waved line arising from it at vein 5 and joining it again at vein 2; a curved waved subterminal line from costa to vein 2 and patch further from termen in submedian interspace; a slightly waved terminal line; cilia black at tips. Hind wing ochreous white; two black striae at discocellulars; an oblique medial line from cell to vein 1 and an oblique line from lower angle bent inwards to inner margin above tornus; postmedial line angled outwards at veins 6 and 5, then oblique to above tornus, an irregularly waved line beyond it from costa to vein 2; a subterminal line from costa to vein 2, slightly excurved at middle; a terminal line; cilia yellow at base and with black line through them.

*Hab.* SURINAM, Paramaribo (*Ellacombe*), 1 ♂ type; Br.

GUIANA, Rockstone (*Rodway*), 1 ♂, 1 ♀ ; BRAZIL, Amazons, Para, 1 ♀. *Exp.* 22-24 mm.

(86 c) *Sylepta polycymalis*, sp. n.

Head, thorax, and abdomen pale yellow ; palpi with black spot at end of second joint ; frons with black spot above ; teguke with two brown spots, patagia with three spots ; fore and mid femora at extremity and fore tibiæ at extremity with black bands ; abdomen with dorsal brown bands. Fore wing pale yellow ; two black points on base of costal area followed by a curved line, then a series of black points ; an oblique slightly waved antemedial line, followed by a brown annulus from costa to median nervure and another below the cell ; a brown bar from costa to lower angle of cell ; a waved postmedial line bent outwards between veins 6 and 2, then retracted to below angle of cell and oblique to inner margin and with a waved line across its sinus between veins 6 and 2, and an oblique bar from it at vein 2 to tornus ; a waved subterminal line from costa to vein 5 connected with termen by a brown patch between veins 6 and 5, some subterminal points on inner half ; a strong blackish terminal line ; cilia with a blackish line through them. Hind wing pale yellow ; a rather diffused sinuous subbasal line from subcostal nervure to inner margin ; an oblique discoidal bar and oblique line from lower angle of cell to tornus ; a waved postmedial line bent outwards between veins 5 and 2, then oblique to above tornus, with an irregularly waved line on its inner side from costa to vein 2 ; a waved subterminal line from costa to vein 2 ; a strong blackish terminal line expanding into a slight patch at apex ; a brown line through the cilia.

*Hab.* BR. E. AFRICA, Machakos (*Crawshay*), 1 ♂ type ; UGANDA, Gondokora (*Reynes-Coles*), 1 ♀ ; BR. C. AFRICA, Zomba (*Johnston*), 1 ♀ ; GAZALAND, Chirinda Forest (*Marshall*), 1 ♂ ; NATAL, Victoria district (*Gooch*), 1 ♀, Durban (*Leigh*), 1 ♂. *Eap.* 26 mm.

(88 c) *Sylepta strigicincta*, sp. n.

♀. Head and thorax orange-yellow ; palpi red-brown towards tips ; fore and mid legs suffused with red-brown ; abdomen clothed with white scales, the base brown, the extremity fulvous yellow. Fore wing orange-yellow ; slight subbasal brownish spots in cell and above inner margin ; the costa brownish to the excurved dark antemedial line, which is incurved and obsolescent at vein 1 ; a black discoidal lunule ; postmedial line formed of small fuscous spots in the

interspaces, arising below costa, incurved at vein 7, excurved to vein 2, then bent inwards; a series of dark striæ just before termen; cilia fuscous. Hind wing orange-yellow; a black discoidal spot; postmedial line rather diffused, fuscous, excurved between veins 5 and 2 and slightly below submedian fold; a series of dark striæ just before termen; cilia fuscous.

*Hab.* ECUADOR, Quevedo, 1 ♀ type. *Exp.* 34 mm.

(92 a) *Sylepta stictigramma*, sp. n.

Head, thorax, and abdomen orange; palpi with black bands; basal joint of antennæ with black point in front; vertex of head with black point; fore tibiæ and tarsi banded black and white; abdomen with two dorsal black bands with white bands before them towards extremity. Fore wing orange; obliquely placed subbasal black spots on costa and inner margin; antemedial black spots at costa, below cell, and inner margin, the costal spot nearer the base; a black discoidal bar; a postmedial series of black points, slightly excurved below vein 7 and bent outwards between veins 5 and 2, ending with a more prominent spot in submedian fold nearer the base; cilia black with a metallic gloss at tips. Hind wing orange; a postmedial punctiform black line, slightly bent outwards between veins 5 and 2, then retracted and with more prominent spot in submedian fold; cilia black at base, silvery grey at tips.

*Hab.* BAHAMAS, Nassau (*Bonhote*), 1 ♂, 1 ♀ type; CUBA, Santiago (*Schaus*), 1 ♂. *Exp.*, ♂ 26, ♀ 24 mm.

(92 d) *Sylepta orthogramma*, sp. n.

♂. Head, thorax, and abdomen orange; tegulæ with medial black spot; fore tibiæ whitish with blackish band at extremity; hind tarsi slightly ringed with blackish towards extremity; abdomen with subdorsal blackish spots on second segment, the terminal half dorsally suffused with fuscous and with two white bands, the ventral surface whitish. Fore wing orange; an oblique black almost basal line; a strong black antemedial line, oblique from costa to submedian fold; a point in middle of cell and discoidal spot; a strong black postmedial line, oblique below discal fold and with cupreous-brown suffusion beyond it between veins 6 and 4, diffused at termen to apex; a black terminal line; cilia fuscous at tips. Hind wing orange; a slight blackish discoidal striga; postmedial line fuscous, oblique from costa to



submedian fold towards termen ; a black terminal line ; cilia tinged with fuscous at tips.

*Hab.* CUBA, Santiago (*Schaus*), 1 ♂ type. *Exp.* 30 mm.

(93 a) *Sylepta planeiflava*, sp. n.

♀. Head, thorax, and abdomen yellow, the last with the base white ; fore tibiæ with fuscous band at extremity, the tarsi ringed with fuscous towards extremity ; pectus and ventral surface of abdomen whitish. Fore wing yellow with very faint traces of deeper yellow antemedial line, discoidal bar, and postmedial line oblique below discal fold. Hind wing rather paler yellow.

*Hab.* BR. N. GUINEA, Mafalu (*Pratt*), 1 ♀ type. *Exp.* 34 mm.

(93 b) *Sylepta holochralis*, sp. n.

♀. Uniform orange-yellow ; palpi with black spot on first joint ; mid femora at extremity and base of tibiæ black.

*Hab.* BR. E. AFRICA, Tanga, 1 ♀ type. *Exp.* 32 mm.

(100 a) *Sylepta methyalinalis*, sp. n.

♂. Head and thorax black-brown, the vertex of head whitish ; palpi banded with whitish ; antennæ ringed black and white ; thorax with some leaden-grey scales ; pectus and legs white, the fore femora and tibiæ with black bands at extremities, the mid tibiæ brown above ; abdomen brown, with white band on second segment and white rings on medial segments, the ventral surface white. Fore wing cupreous brown ; the costal area fulvous yellow to postmedial line ; a sinuous dark antemedial line defined by white marks on each side with a small quadrate white spot beyond it in cell ; a quadrate hyaline white patch in end of cell ; a slight pale discoidal striga ; postmedial line excurved between veins 5 and 2, then retracted to lower angle of cell and angled outwards on vein 2, with trifid hyaline patch beyond it from costa to vein 5, two spots before it between veins 6 and 5, a patch in its sinus and a patch beyond it extending to termen above tornus, two spots beyond it above and below vein 2 and one before it in submedian interspace ; a dark terminal line ; cilia chequered white and brown. Hind wing semihyaline white ; the base with slight blackish marks ; a blackish discoidal annulus ; a fine postmedial line excurved to near termen between veins 5 and 2, then retracted and interrupted to near tornus ; a black-brown apical

patch extending to vein 4 and a spot below vein 2; a fine terminal line; cilia white, chequered with black towards apex.

*Hab.* BR. GUIANA, Potaro R. (*Kaye*), 1 ♂ type. *Exp.* 30 mm.

(109 a) *Sylepta achromalis*, sp. n.

♀. Pale brownish ochreous; palpi fuscous above; thorax tinged with fulvous; fore tibiæ fuscous at extremities; pectus, mid and hind legs, and ventral surface of abdomen white; wings uniform glossy ochreous; fore wing with faint dark point in middle of cell and discoidal lunule.

*Hab.* S. LEONE (*Clements*), 1 ♀ type; NIGERIA, Sapele (*Sampson*), 1 ♀; CAMEROONS (*Sjostedt*), 1 ♀. *Exp.* 24 mm.

(111 a) *Sylepta disticta*, sp. n.

♂. Head, thorax, and abdomen fuscous brown with a slight purplish-grey gloss; palpi with the basal joint white; pectus and ventral surface of abdomen except at extremity whitish. Fore wing fuscous brown with a purplish-grey gloss; small white postmedial spots above and below vein 7; a punctiform white line at base of cilia. Hind wing fuscous brown with a cupreous gloss; a fine white line at base of cilia.

*Hab.* DUTCH N. GUINEA, Fak-fak (*Pratt*), 1 ♂ type. *Exp.* 32 mm.

Genus SYNGROPIA, nov.

Type, *S. stictica*.

Palpi upturned, the second joint reaching to middle of frons and moderately scaled, the third short, naked; frons rounded; antennæ of male ciliated. Fore wing with veins 3 and 5 from near angle of cell; 6 from below upper angle; 7 from angle, straight and well separated from 8, 9, which are stalked; 10 approximated to 8, 9 towards base. Hind wing with vein 3 from angle of cell; 4, 5 strongly stalked; 6, 7 from upper angle; 8 anastomosing with 7.

*Syngropia stictica*, sp. n.

*Notarcha æchmisalis*, Druce, Biol. Centr.-Am., Het. ii. p. 248 (nec Wlk.).

Head and thorax yellowish white; fore tibiæ with blackish band at extremity; abdomen yellowish white suffused with fulvous except at base and extremity and with subdorsal black spots on second segment. Fore wing yellowish white;

obliquely placed subdorsal blackish spots below costa and above inner margin ; an antemedial bar from below costa to median nervure and a bar above inner margin ; postmedial line blackish, forming slight spots at veins, excurved between veins 6 and 3, then incurved ; terminal blackish spots above veins 6 and 3. Hind wing semihyaline yellowish white ; an oblique blackish postmedial bar between veins 6 and 3 and an oblique line from vein 2 to tornus ; terminal blackish spots at apex and vein 3.

*Hab.* GUATEMALA, San Gerónimo (*Champion*), 1 ♂, 1 ♀ type, Godman-Salvin Coll. *Exp.*, ♂ 22, ♀ 26 mm.

(1 a) *Lygropia phæocraspia*, sp. n.

Hind wing of male with a tuft of long hair from base of inner margin on underside.

♂. Head and shoulders cupreous fuscous ; antennæ pale ochreous ; tufts of hair on neck and thorax ochreous ; pectus and legs ochreous white, the tibiæ and tarsi suffused with fuscous ; abdomen ochreous suffused with fuscous. Fore wing ochreous, the costa fuscous, narrowly on postmedial area, the terminal area fuscous black, its inner edge slightly waved and bent inwards at vein 2 ; a faint blackish antemedial line, oblique to just below the cell ; a black annulus in middle of cell and an oblique discoidal lunule defined by black and connected by streaks at middle and lower extremity with the black postmedial line which is incurved at discal fold, excurved and minutely waved between veins 5 and 2, then bent inwards on vein 2 and with a spot below it ; cilia whitish, chequered with blackish at apex and at veins 5 to 2. Hind wing ochreous white ; a black discoidal spot ; postmedial line blackish, with a spot at discal fold, excurved and minutely waved between veins 5 and 2, then bent inwards and with a spot below vein 2 ; the terminal area blackish with some ochreous on termen at middle ; cilia whitish with a blackish line near base from apex to vein 2.

*Hab.* W. COLOMBIA, San Antonio (*Palmer*), 1 ♂ type. *Exp.* 28 mm.

(6 a) *Lygropia pogonodes*, sp. n.

Hind wing of male with a large tuft of black hair on tornal half of inner margin on upperside.

♂. Head, thorax, and abdomen orange-yellow. Fore wing orange-yellow ; a small round black discoidal spot ; terminal area faintly clouded with fuscous. Hind wing

orange-yellow, the terminal area faintly clouded with fuscous to vein 2; the tuft of hair on inner margin deep black.

♀. Hind wing without the tuft of black hair on inner margin.

*Hab.* N. NIGERIA, Baro (*Macfie*), 1 ♂ type; TRANSVAAL, White R. (*Cooke*), 1 ♀. *Exp.* 30 mm.

(6 b) *Lygropia heliosalis*, sp. n.

Mid tibiæ of male dilated, with a fold enclosing a tuft of long hair.

♂. Deep orange; fore tibiæ blackish at extremity. Fore wing with the costa blackish towards apex, the cilia black except at tornus. Hind wing with the termen slightly tinged with black at apex, the cilia black except at tornus.

*Hab.* ARGENTINA, Gran Chaco, Florenzia (*Wagner*), 1 ♂ type. *Exp.* 20 mm.

(6 c) *Lygropia flavivialis*, sp. n.

♂. Brown; palpi in front, sides of frons, vertex of head, pectus, greater part of legs, and ventral surface of abdomen yellow. Fore wing with oblique yellow medial band broad at costa, narrowing to inner margin. Hind wing with broad yellow band from middle of costa to middle of termen, widest at costa and termen; cilia yellow with a brown line through them.

*Hab.* BRAZIL, São Paulo (*D. Jones*), 1 ♂ type. *Exp.* 24 mm.

(6 d) *Lygropia chrysozonalis*, sp. n.

♂. Head, thorax, and abdomen black-brown with a purplish gloss; palpi with white patches at base and in front of second joint, the third joint white; frons with white patches at sides and orange band above and between antennæ; neck with orange ring; fore tibiæ with white band; tarsi white except at extremity; ventral surface of abdomen white. Fore wing black-brown with a purplish gloss; a very broad oblique orange band from middle of costa, towards which it expands, to terminal third of inner margin. Hind wing black-brown with a purplish gloss; a large wedge-shaped orange patch on costa from middle to just before termen extending to just below vein 4; a fine white line at base of cilia.

*Hab.* PERU (*P. O. Simons*), 1 ♂ type. *Exp.* 24 mm.

[To be continued.]



II.—*Descriptions and Records of Bees.*—XLV.  
By T. D. A. COCKERELL, University of Colorado.

*Bombus lateralis wilmattæ*, subsp. n.

Worker.—Hair of head black or with a little pale on front; hair of thorax very pale yellow, with a broad black band between wings; hair of abdomen pale yellow on first dorsal segment, middle half of second, and a small elongate triangle of yellow (sometimes nearly obsolete) on middle of third; the apex of the little triangle points towards the second segment, the yellow of which is emarginate in the middle. Compared with a worker *lateralis* from Costa Rica (*Bruner*) our insect averages distinctly smaller (length about 13 mm.); the yellow hair is paler and includes the anterior and posterior parts of thorax above; the ocelli are distinctly smaller, and the malar space is perhaps a trifle shorter. The brownish wings are the same.

*Hab.* Antigua, Guatemala (type locality), six (*W. P. Cockerell*); Guatemala City, Guatemala, four (*W. P. Cockerell*).

The original *B. lateralis*, Sm., was described from the mountains of Guatemala, at a higher altitude than the localities of *wilmattæ*. I think it is probable that the difference is only racial, the form from the higher altitudes being more melanic. It is the Guatemala City form in which the yellow triangle on the third segment is evanescent.

*Psithyrus guatemalensis*, sp. n.

♂.—Length about 17 mm.; anterior wing  $11\frac{1}{2}$ .

Black, with the elongate obconical abdomen; malar space broader than long; antennæ black, the flagellum rather thick, its joints not in the least arcuate; hair of head long and black, a little pale on lower part of front, that on top of head behind ocelli entirely very pale ochreous, but that on cheeks black; hair of thorax long and loose, very pale ochreous, a moderate amount of black on posterior middle of mesothorax and middle of scutellum, hair of hind part of pleura (especially a tuft beneath wings) and of metathorax black; tegulæ with a rufous spot posteriorly. Wings dusky, strongly reddish. Legs with black hair, that on inner side of tarsi dark red except at base; hind tibiæ slender, convex; hind basitarsi hardly as broad as tibiæ. Abdomen shining, with abundant black hair, but a large pale ochreous tuft at

each side of first segment, and small yellowish-white tufts on sides of segments 3 to 5.

Distinguished from the North-American species by the colours of the pubescence; also as follows:—Compared with *P. tricolor*, Franklin, it is rather less robust, and the hair of the abdomen is considerably shorter; the wings are much redder; malar space shorter (its length perhaps a trifle greater than width of mandibles at base, but in *tricolor* much greater); mandibles much more slender; third antennal joint shorter; hair of hind tibiæ and basitarsi very much shorter, mostly not longer than half diameter of leg. (The male of the European *P. quadricolor*, Lep., has even shorter hair on hind basitarsus, but long hair on the tibia. The male of the European *P. campestris* (Panz.) has the hair on hind tibia and tarsus practically as in *P. guatemalensis*.)

*Hab.* Guatemala City, Guatemala (*W. P. Cockerell*).

The first *Psithyrus* from Central America.

*Anthophora usticauda*, sp. n.

♀.—Length about  $10\frac{1}{2}$  mm.

Black; tarsi reddish at apex; eyes green; antennæ black; clypeus with a rather broad, subapical, transverse, yellow band, interrupted in middle; labrum densely and strongly punctured, yellow except narrow apical margin and a large spot at each upper corner; mandibles with a large more or less bilobed yellow mark; malar space almost obsolete; hair of face and cheeks white, stained with ochreous on front; hair of vertex long and black (not going so far forward as anterior ocellus), of occiput ochreous; hair of thorax above mixed pale fulvous and black, at sides and behind a livelier fulvous, without black, but on lower part of pleura white; tegulæ rufo-piceous. Wings smoky, nervures black; anterior femora and trochanters with long white hair behind. Hair on outer side of legs fulvous (that of hind tibiæ abundant, shining), but brush on end of hind basitarsus black; hair on inner side of middle and hind tibiæ and basitarsi black; spurs ferruginous. Abdomen ornamented with appressed, scale-like, rufo-piceous pile, with black hairs intermixed; the rufo-fulvous parts include rather narrow apical margin of first segment, broader margin of second, most of third except a narrow longitudinal median band and a large basal area on each side, fourth except a median stripe and a little space at extreme sides, fifth (the colour paler) except a large black median triangle; beneath, the abdomen has white hair.

*Hab.* Antigua, Guatemala (type locality), four (*W. P. Cockerell*) ; Amatitlan, Guatemala, one, Feb. 5, 1912 (*W. P. Cockerell*).

The third abdominal segment may be without evident dark basal areas. This is a very red member of the subgenus *Micranthophora*, and is closely related to the Mexican *Anthophora squammulosa*, Dours, differing by the absence of any border of dark hair to the abdominal segments, the black hair of vertex not mixed with white, the smoky wings, &c.

*Caelioxys sanguinosus*, sp. n.

♀.—Length about 11 mm.

Black, with the tegulae and legs very bright ferruginous ; venter of abdomen also red, as well as first dorsal segment (except middle of apical margin narrowly), and sides of second and third more or less, the red extending suffusedly and obscurely over a good part of second ; mandibles stout, red, with black apex ; lateral margins of labrum broadly red ; eyes purplish, their hair very short ; sides of face and region about antennae with pure white hair ; clypeus finely hairy, but not enough to hide the finely rugose gently convex surface, the lower margin straight and entire ; antennae entirely black ; vertex with large punctures ; cheeks densely covered with white hair ; thorax with the usual hair-bands and spots, the dorsal ones creamy ; mesothorax shining, with very large, not very dense punctures ; scutellum with large punctures, closely placed, but a small smooth space in the middle ; middle of hind margin of scutellum with a small but conspicuous shining triangular tooth ; axillar spines straight, rather long, with large punctures. Wings dusky toward apex, a fuliginous purplish streak in upper part of marginal cell ; recurrent nervures joining second s.m. equally distant from base and apex. Hair on inner side of tarsi shining light yellowish. Abdomen with very narrow, entire, pure white hair-bands ; first dorsal segment with scattered strong punctures ; second to fifth rather well punctured basally, but beyond that smooth and with few punctures except at sides ; last dorsal with small punctures and a feeble keel, the apex rather thick and very obtuse ; last ventral prolonged some distance beyond last dorsal, broad and spoon-shaped, margined with very short dark hair, neither notched at sides nor with a terminal appendage ; penultimate ventral segment only moderately produced, sparsely punctured.

*Hab.* Gualan, Guatemala (*W. P. Cockerell*).

In my table in 'Psyche,' October 1905, this runs to *C. terana*, Cresson, which, however, has the middle and hind tarsi black, and differs in other ways. The shape of the last dorsal segment resembles that of *C. comstockii*, Cress., but there is a slight median nodule in the middle of the apical truncation; in other characters the insect is quite unlike *comstockii*. In Schrottky's table of Brazilian species it runs to *C. ignava*, Sm., which has a quite different apex of abdomen.

*Xenoglossa assimilis* (Smith).

Quirigua, Guatemala; two males at flowers of *Ipomœa sidefolia*, Choisy, Feb. 12 and 20 (*W. P. Cockerell*).

This is *Melissodes assimilis*, Smith; it is a *Xenoglossa* related to *X. pruinosa*, Say. The maxillary palpi are five-jointed, the fifth joint very short.

*Agapostemon proscriptus*, sp. n.

♀.—Bright green, with the size and general appearance of *A. radiatus*, Say, but differing as follows:—Base of metathorax coarsely rugose, without well-defined ridges; broad basal bands of white hair on abdominal segments 2 to 4 more conspicuous; knees (broadly), tibiae, and tarsi ferruginous; hair on inner side of hind tarsi orange-fulvous; second s.m. very broad, broader than high. The mandibles are light yellow basally and rufous apically; the labrum is dark reddish.

*Hab.* Guatemala City, Guatemala, two (*W. P. Cockerell*).

Resembles the little-known *A. pulcher*, Smith, but the wings are distinctly dusky (somewhat yellowish), and the femora are black except at apex. Both specimens have gathered bright orange pollen.

*Megachile zeemeniæ*, sp. n.

♀.—Length about 12 mm.

Black, rather long and parallel-sided, general appearance much like *M. lenticula*, Vachal; head broad; eyes purplish; clypeus short and broad, closely punctured, with a rudimentary median ridge, the lower margin gently concave, with a median tubercle; mandibles broad, black, the two apical teeth distinct, the long inner cutting-edge without distinct teeth; supraclypeal area shining, convex, with scattered distinct punctures; hair of face creamy white, mixed with black, long black hairs from each side directed toward



middle of clypeus; hair of vertex black, of cheeks white; antennæ black, ordinary; mesothorax dullish, finely punctured, quite closely except posterior middle, with sparse short black hair, and a little pale in front; scutellum with conspicuous black hair; scutello-mesothoracic suture with a narrow band of dense pale orange tomentum; postscutellum and metathorax with creamy white hair; pleura with white hair below, but a tuft of black just below wings, contrasting with the dense creamy hair bordering tubercles; tegulae picuous. Wings dusky translucent, darker apically, especially beyond end of marginal cell; nervures black. Legs black, with mostly whitish hair, that on inner side of tarsi and inner side of middle tibiae orange-ferruginous; spurs yellowish white; claws simple; hind basitarsi broad and flat; abdomen of the parallel-sided type, above dense black, very finely punctured, with very short black hair, some pale hair on first segment, and very fine pale (yellowish) pruinosity on sixth, also extremely narrow apical yellowish hair-bands on the segments, only at sides on first; ventral scopa very bright orange-ferruginous, with some black at sides of third and following segments, black on last segment except at base.

*Hab.* Quirigua, Guatemala, at flowers of *Zexmenia virgulta*, Klatt (*W. P. Cockerell*, 42).

Related to *M. mexicana*, Cress., and *M. zapoteca*, Cress. From *mexicana* it is known by the largely black hair on face and the larger size; from *zapoteca* also by the size and the colours of the ventral scopa. I was a little in doubt whether to refer it to *M. zapoteca*, but after carefully reading Cresson's description I believe it must be distinct.

#### *Megachile tuxtla*, Cresson.

Male from Guatemala City (*W. P. Cockerell*); female from Antigua, Guatemala (*W. P. Cockerell*).

The female has not been described; it is like the male except in the usual sexual characters; clypeus with black hair, but sides of face with white; ventral scopa pale ferruginous, becoming white basally, black on apical segment; abdomen broad, shovel-shaped; hair on inner side of tarsi very bright orange-ferruginous; hind basitarsi only moderately broadened. In Friese's table of females of the Mexican region ('Das Tierreich,' 28 Lief.) it runs nearest to *M. mexicana*, Cress.

At Antigua my wife also took a female *M. chrysophila*, Ckll.

*Megachile montezuma*, Cresson.

Quirigua, Guatemala, one female (*W. P. Cockerell*).

*Megachile aurantipennis*, sp. n.

♀.—Length about 8 mm.; anterior wing 7.

Black, short and broad, the antennæ, mandibles, and legs black, spurs dark; head large; mandibles broad, of the quadridentate type, but the teeth little developed; clypeus convex, shining, densely punctured. at sides, sparsely in middle, the lower margin broadly and quite deeply emarginate, with a median tubercle; mouth-parts rather short; cheeks about half as wide as eye; front, vertex, and cheeks very densely punctured, with largely appressed shining ochreous pubescence, only moderately dense; a little band of the same shining hair extends down anterior orbits, but is overlapped by black hair; mesothorax densely covered with appressed shining ochreous (golden-brown) hair, tubercles densely tufted with pale hair, and a tuft of fulvous hair behind the wings; pleura strongly punctured; tegulæ ferruginous, with a basal tuft of short black hair. Wings orange-ferruginous, with ferruginous nervures and unusually large stigma; apical field brownish hyaline, not orange, the apex of marginal cell and beyond fuscous. Hair on inner side of tarsi red; hind basitarsus broad and flat. Abdomen short and broad, fourth and fifth segments with broad dense apical bands of golden-ochreous hair, and sixth covered with the same; ventral scopa pale golden-ochreous, without black, at base (second segment) with a large V-shaped band of yellowish-white hair.

♂.—Length about 6 mm.

Similar to the female, except in the usual sexual characters and those now given; clypeus not emarginate, almost without punctures in middle; sides of face with conspicuous pale golden-ochreous hair, not overlapped with black; antennæ long, ordinary; base of metathorax with a median groove; tegulæ rufo-piceous. Wings dusky ferruginous instead of clear orange. Anterior legs simple; no coxal spines. First abdominal segment fringed with ochreous hair; end of abdomen with two short, sharp, black spines, far apart.

*Hab.* Quirigua, Guatemala, one of each sex, at flowers of plant no. 15, Feb. 11, 1912 (*W. P. Cockerell*). The male is the type.

Allied to the Mexican *M. bidentis*, Ckll., but easily separated by the hair on the mesothorax and the colour of the

wings. In Friese's table ('Das Tierreich') the female runs nearest to *M. candida*, Sm., which is much larger and altogether different, or perhaps equally well to the vicinity of *M. zapoteca* and *palmeri*, which are even more different, if that is possible. The male runs nearest to *M. bidens* and *tuxtila*, much larger species. It is worth while to note that the species of *Megachile* which I described in 1896 from tropical Mexico are placed in 'Das Tierreich' among the species of the United States, and are quite erroneously stated to come from Utah and New Mexico. I make the male of *M. aurantipennis* the type, because the separation from the allied *bidentis* is necessarily based on a comparison of males, only this sex of *bidentis* being known. By some strange error, the original description of *bidentis* states that the insect is a female; it is, in fact, a male. In male *bidentis* the fifth and sixth abdominal segments are densely covered with golden-ochreous hair, and the apex has a pair of short triangular teeth or tubercles; in male *aurantipennis* the fifth is largely dark (the surface showing) at base and the end is bispinose. Male *bidentis* has the wings coloured like female *aurantipennis*; male *aurantipennis* has them much browner, the orange being mixed with fuscous. It is possible, perhaps, that the female described under *aurantipennis* really belongs to *bidentis*, but considering the circumstances of capture this is unlikely. No doubt the females of the two will be found to be very much alike, the male *aurantipennis* having diverged from the common type. Another very close relative is the Brazilian *M. microsoma*, Ckll. In this (male) the tuft of hair on upper part of sides of metathorax is black and the wings are not reddened. The apex of the abdomen is nearly as in *aurantipennis*.

*Megachile (Oligotropus) gualanensis*, sp. n.

♀.—Length 8–9½ mm.

Parallel-sided, black (including antennæ, mandibles, and legs), with white hair, on clypeus with long coarse black hairs intermixed, and the same (hardly so conspicuous) on scutellum and hindmost part of mesothorax; ventral scopa white, on last segment black with some pale at sides; the four teeth on apical margin of clypeus rather poorly developed and variable; tegulæ piccous at base, testaceous outwardly. Wings greyish hyaline, nervures piccous. Abdomen with narrow white hair-bands.

♂.—Length 7–8 mm.

Anterior legs simple; sixth abdominal segment feebly bituberculate, the tubercles very close together.

*Hab.* Gualan, Guatemala, five females, eight males (*W. P. Cockerell*, 1). The female is the type.

In Friese's table the female runs to *M. zaptlana* and *M. abacula*, the male runs to *M. abacula* and *M. bipartita*. *M. gualanensis* is, in fact, very close to *M. zaptlana*, Cress., but the female has less black hair on head and the wings are not fuliginous on apical costal margin. Otherwise Cresson's description of *zaptlana* practically agrees. *M. abacula*, Cress., differs at once by the fulvo-ochraceous hair on abdomen. Among the United States species, *M. gualanensis* stands nearest to *M. subexilis*, Ckll. The male flagellum is proportionately shorter in *gualanensis* than in *subexilis*, and in the female the distance from the top of the eye to the occipital margin is much less in *gualanensis* than in *subexilis*.

*Melissodes raphaelis*, Cockerell.

Quirigua, Guatemala (*W. P. Cockerell*). One female at yellow composite, less robust than types. Six normal males (one at flower no. 7; two, Feb. 11, at flower no 15; one, Feb. 12, at *Ipomœa sidaefolia*, Choisy); one male with fulvous hair on head and thorax above, the only dark hairs a few on scutellum; eight variously intermediate males (three, Feb. 11, at flower no. 15; one, Feb. 12, at *Ipomœa sidaefolia*).

In spite of the great variation all are evidently one species. The lighter-haired male is easily distinguished from *M. floris*, Ckll., by the deep notch on each side of yellow of clypeus, black hair on outer side of hind tibiæ, and colours of abdomen.

*Melissodes tepaneca aschenborniana*, subsp. n.

♂.—Differs from *M. tepaneca*, Cresson, by having the fifth abdominal segment with pale hair like the fourth, though the sixth has it black; second segment with black hair between the basal and median band (it is ochreous in *tepaneca*); median band of second segment narrower; hair on hind tarsi shorter; wings more dusky. It is very like *M. masuca*, Ckll., from Texas, but smaller, with the second abdominal segment between the bands more closely punctured and the eyes differently coloured (light green). The middle and hind tibiæ at apex and their tarsi are ferruginous; labrum, large spot on mandibles, and clypeus yellow, the last with the usual spots, but the yellow not notched;



flagellum black above, clear ferruginous beneath; tegulae bright ferruginous. The type has the hair of thorax above bright orange-fulvous, and that of abdomen all (except the black) warm reddish; the other specimen has the hair of thorax above pale ochreous and the median bands on second and following abdominal segments white. The hind margins of the abdominal segments are broadly more or less pallid. The middle of the mesothorax is shining, with rather sparse strong punctures.

*Ha<sup>b</sup>*. Gualan, Guatemala (*W. P. Cockerell*). Two at flowers of *Vernonia aschenborniana*, Schauer.

I treat this as a subspecies of *M. tepaneca*, on account of the geographical proximity of that insect, but by the characters it is actually closer to the Texan *M. masuca*.

*Exomalopsis pulchella*, Cresson.

Quirigua, Guatemala (*W. P. Cockerell*). Two females; one has the hair behind ocelli pale ochreous, the other (from flowers of *Zexmenia virgulta*, Klatt) has hair behind ocelli and on scutellum black, and the stigma and nervures bright ferruginous.

*Thygater cockerelli* (Crawford).

Quirigua, Guatemala (*W. P. Cockerell*). One female, at flowers of no. 420.

*Thygater nigravillosa* (Crawford).

Quirigua, Guatemala (*W. P. Cockerell*). Two males, Feb. 20, at flowers of *Ipomœa sidæfolia*, Choisy.

*Leptergatis armata* (Smith).

Quirigua, Guatemala (*W. P. Cockerell*). Twenty females (mostly Feb. 20), four males (two, Feb. 20; one, Feb. 12; one at flowers of *Zexmenia virgulta*).

It is almost impossible to separate the females of this from *Leptergatis toluca* (*Melissodes toluca*, Cresson), but the males are easily separated by the hind legs.

*Leptergatis toluca* (Cresson).

Gualan, Guatemala (*W. P. Cockerell*). One male, Feb. 15, at flowers of *Cordia alba*, R. & S.

*Tetrapedia mayarum*, sp. n.

♂.—Length nearly 10 mm.

Black, with the labrum (except a median basal reddish spot), patch at base of mandibles, and broad lower corners of clypeus pellucid whitish; hind tarsi clear ferruginous, with their hair entirely orange-ferruginous; an obscure round red spot on inner side of hind tibiæ near apex; hair of head and thorax scanty, black above, silvery-white on cheeks, sides of face, and lower parts of pleura and metathorax; head shining; clypeus with strong punctures, dense in middle of sides; front with extremely fine punctures and an oblique groove on each side; sides of occiput with a sharp elevated margin; antennæ dark, the scape with a light yellowish-red spot at base, flagellum red beneath; mesothorax and scutellum dull, with a granular appearance; base of metathorax punctured; tubercles with short dark brown hair; tegulæ shining black. Wings dark fuliginous, a little paler apically, nervures fuscous, stigma amber-colour; second s.m. considerably narrowed above, receiving first r. n. about halfway between middle and apex. Legs black (except as stated above), small joints of tarsi obscure reddish; posterior apex of hind tibiæ broadly and thickly covered with red hair like that on tarsus; anteriorly the hind tibia has some white hair near end; anterior and middle legs with the hair black, partly red on tarsi; anterior tibiæ smooth and shining on outer side; anterior basitarsi broad and thick; middle basitarsi broad and flat, truncate at apex, with an obtuse lobe on inner apical corner; hind coxæ and trochanters simple; hind basitarsi very broad and flat, with a triangular process on inner margin a little before middle; spurs dark, simple. Abdomen smooth and shining, dorsally without markings; apical segment triangular, ending in a pencil of hair; fourth ventral with an undulate margin and its base broadly yellowish white; sixth ventral triangularly produced.

♀.—Length about 11 mm.

Similar to the male, except for the usual sexual characters; mandibles ferruginous; labrum black, with a red spot on each side, and fringed with copper-red hairs; face entirely black; clypeus well punctured; scape suffusedly red at base; scutellum somewhat bigibbous; claw-joints all red; hind tarsi only obscure reddish, except apically; spurs simple; hind femora with a red patch near apex; hind tibiæ behind with a curious patch of pure white material near apex, among the black hairs, the same on each side, entangled in pure white very long-plumose hairs; on inner side of

hind tibiæ the hair is red apically ; hind basitarsi with hair black on outer side and behind, on inner side and the broad apical brush red, in front of basal part broadly white ; fifth dorsal abdominal segment with a large cream-coloured spot on each side.

*Hab.* Quirigua, Guatemala (*W. P. Cockerell*). One of each sex.

Related to *T. bunchosiæ*, Friese, but in the female the third ventral segment is like the second (not opaque and strongly punctured), while in the male the clypeus has less pale colour, and there are other differences. There are several more or less related species in South America, none having the same structure in detail as *T. mayarum*.

*T. bombitarsis*, Vachal, must belong to this group, and, if so, is not allied to *T. maura*, as Vachal states. The groups containing *maura* and *bunchosiæ* differ in the spurs and otherwise, and are only superficially similar.

Named after the Mayas, who built temples and made remarkable sculptured monuments at Quirigua. The male is the type.

At flowers of *Pontederia cordata*, L., at Quirigua, Feb. 11, 1912, Mrs. Cockerell took females of *Tetrapedia calcarata*, Cress., and *T. mæsta*, Cress.

### III.—*Preliminary Descriptions of Eleven new Crinoids belonging to the Families Himerometridæ, Mariametridæ, and Colobometridæ, discovered by the 'Siboga' in the Dutch East Indies.* By AUSTIN H. CLARK.

THE new unstalked crinoids described below will be considered in greater detail and figured in the memoir covering the comatulids in the 'Siboga' reports ; as the very extensive collection brought back by the 'Siboga' will require a large amount of study, especially as regards the data bearing on the geographical distribution of these animals and on allied problems, it has seemed advisable to publish descriptions of the new forms discovered in advance of the final report.

#### Family Himerometridæ.

##### *Amphimetra propinqua*, sp. n.

This species is most closely related to *A. producta*, but it differs from that form in its longer and more slender cirri, which are composed of much longer segments.

The cirri are VIII–XIII, 24–36 (usually 30–33), 26 mm. to 32 mm. (usually about 30 mm.) long; they are very slender, and taper gradually in the proximal third, being especially slender from that point onward; all the cirrus segments are approximately subequal in length, about twice as long as broad at the ends, though those in the distal third of the cirrus are slightly carinate, which makes them appear slightly shorter, and those in the proximal half are slightly longer, with slightly expanded ends; in the outermost segments there is a slight indication of dorsal tubercles.

The arms vary from ten to thirteen in number, and are from 90 mm. to 120 mm. long.

*Type Locality.* 'Siboga' Station No. 318; north-east of the east end of Java; 88 metres.

### Family Mariametridæ.

#### *Selenometra tenuicirra*, sp. n.

This new form is closely related to *S. finschii*, from which it differs in the structure of its cirri, which are longer and more slender, and are composed of more elongated segments.

The cirri are from 55 mm. to 70 mm. long, and are composed of 69–78 segments, of which the distal are nearly or quite as long as broad, instead of twice as broad as long or even broader as in *S. finschii*, and the more proximal are about twice as long as broad instead of slightly, when at all, longer than broad as in *S. finschii*.

P<sub>1</sub> is 11 mm. long and is composed of twenty or twenty-one segments, of which the first is short, the following gradually increasing in length and becoming about as long as broad on the fifth or sixth and twice as long as broad distally; P<sub>2</sub> is 12 mm. long, with twenty-two segments, and resembles P<sub>1</sub>; P<sub>3</sub> is 10 mm. long, with eighteen segments, and resembles P<sub>2</sub>; P<sub>4</sub> is 7.5 mm. long, with thirteen segments, and tapers more in its distal portion than P<sub>3</sub>; P<sub>5</sub> is 7 mm. long, with thirteen segments, and is slightly more slender than P<sub>4</sub>, especially distally; the distal pinnules are 8 mm. long, with seventeen segments.

*Type Locality.* 'Siboga' Station No. 320; north of the east end of Java; 82 metres.

#### *Mariametra tenuipes*, sp. n.

The centrodorsal resembles that of the other species of the genus; the dorsal pole is slightly convex, finely tubercular, 1 mm. in diameter.



The cirri are XXVI, 24-29, 22 mm. long: the first segment is short, the second is about twice as broad as the median length, the third is slightly longer than broad to half again as long as broad, and the sixth to the eighth are about three times as long as their median diameter; the following gradually decrease in length, so that the last ten or eleven are about as long as the distal diameter or only very slightly longer; the cirri are exceedingly slender; the longer proximal segments have slightly prominent ends; slight subterminal dorsal spines are found on the eleventh and following.

The arms are about fifteen in number and about 45 mm. long; together with the division series they resemble those of the other species of the genus. The lateral ornamentation on the ossicles of the IBr series is confined to the lateral third of the dorsal surface; distally it gradually narrows, disappearing at the base of  $P_1$ ; it consists of very numerous small blunt spines, more or less coalescent, which exhibit a tendency to become arranged in horizontal rows.

*Type Locality.* 'Siboga' Station No. 294; off the south coast of Timor; 73 metres.

*Mariametra tuberculata*, sp. n.

This species is nearest to *M. delicatissima*; but in that form the lateral ornamentation of the division series is merely a slight roughening.

The centrodorsal is large, thick discoidal, the dorsal pole slightly convex, 2 mm. in diameter; the cirrus sockets are arranged in two closely crowded and irregularly alternating rows.

The cirri are XXI, 25-27, 20 mm. long; they are long and rather slender with a slight distal taper: the first segment is short, the second slightly longer, the third nearly as long as broad, the fourth slightly longer than broad; after the tenth the segments slowly decrease in length, so that the last four or five before the penultimate are about as long as broad to about one-third longer than broad; the outer eleven or twelve have a slight distal dorsal carination, which is low and rises very gradually from the dorsal surface, but ends rather abruptly distally.

The radials are concealed in the median line, and are only slightly visible in the interradian angles; the IBr<sub>1</sub> are very short, almost oblong, five or six times as broad as long; the axillaries are very short, nearly or quite three times as broad as long; the IIBr and IIIBr series are 2, the latter developed externally; the sides of the division series are in close

apposition and are sharply flattened laterally; the proximal edge of the  $IBr_1$  is everted and slightly scalloped; the anterior edges of the axillary are slightly everted, but smooth; the lateral third of these two ossicles taken together bear a dozen or a dozen and a half prominent well rounded and entirely separated tubercles, some of which may be laterally elongated; the sides of the ossicles of the  $IIBr$  series are similarly, though not so extensively, modified, this modification being bordered interiorly by a more or less marked prominent beaded ridge or row of tubercles, which, however, may be absent.

The type specimen has about twenty-six arms, which are 75 mm. long.

*Type Locality.* 'Siboga' Station No. 51; southern portion of Molo Strait; 69-91 metres.

*Dichrometra tenuicirra*, sp. n.

In all the details of its general structure this species agrees with *D. flagellata*, but it is sharply separated from that form by the curious character of its cirri, which are long and slender, with elongate, though spinous, distal segments.

The centrodorsal is low hemispherical, with very sloping sides; the dorsal pole is slightly convex, flat, or very slightly concave, 1.5 mm. to 2 mm. in diameter; the cirrus sockets are arranged in two or in two and a partial third marginal rows.

The cirri (in the type) are XXVIII, 25-28, 20 mm. to 25 mm. long, slender and delicate: the first segment is very short, the second is twice as broad as long, the third is slightly broader than long, the fourth is half again to twice as long as the median diameter, and the fifth is from two to two and one-half times as long as broad; the following to the ninth, tenth, or eleventh (the latter usually a faintly marked transition segment) are similar, but those following are slightly shorter, about half again as long as broad; the tenth, eleventh or twelfth, and following bear prominent triangular median spines; the earlier of these spines occur about in the centre of the dorsal line of the segments; their anterior (distal) margin stands out vertically and is from one-third to one-half as long as the recumbent side; the hypotenuse from the apex of the spine to the proximal base is usually straight, but there may be a slight tubercle where it merges with the dorsal surface of the segment; sometimes it is more or less concave, leading from the dorsal spine to a smaller blunt proximal tubercle; the spines change but little distally; their bases become shorter and their apices

consequently sharper; the longer earlier segments have slightly enlarged distal ends; this character persists to the end of the cirrus, but is less marked on the spinous distal segments.

The division series and the arms resemble those of *D. flagellata*, but are much more slender and delicate; the division series and first brachials may be well separated or in lateral contact; they are usually not quite in apposition, though possessing straight lateral edges which are slightly swollen, suggesting the lateral processes seen on the proximal ossicles of the species of *Stephanometra*, though their outer margin is straight instead of convex. The characteristic rugose arm-structure and the low though prominent synarthrial tubercles of *D. flagellata* are reflected in a delicate and modified form.

*Type Locality.* 'Siboga' Station No. 320; north of the eastern end of Java; 82 metres.

### Family Colobometridæ.

#### *Cyllometra gracilis*, sp. n.

This new species is related to *C. manca*, but differs markedly in its longer and more slender cirri, which are composed of longer segments.

The centrodorsal is discoidal, the dorsal pole flat or slightly concave, 2 mm. in diameter; the cirrus sockets are arranged in one and a partial second marginal row.

The cirri are (in the type) XXIII, 25-30 (usually nearer the latter), 21 mm. long: the first segment is short, the second is about twice as long, from one-third to one-half again as broad as long, the third is slightly longer than broad, the fourth and fifth progressively increase in length, and the sixth to the ninth or tenth are the longest, about twice as long as their proximal diameter; the following segments gradually decrease in length, so that the last twelve before the penultimate are subequal, slightly longer than broad; as a whole the cirri are long and unusually slender; owing to the crowded condition of the cirri on the centrodorsal the first segment is sharply flattened laterally against the first segments of the cirri on either side; the distal dorsal edge of the fourth and following segments is slightly swollen, this after the seventh becoming a trio of dorsal spines, a central, larger, and two smaller, lateral; the central spine projects more dorsally than do the other two, but does not extend so far distally; all are very small; on the last twelve or fifteen segments before the penultimate

the lateral spines disappear and the median becomes slightly more prominent, occurring as a small single submedian tubercle directed obliquely forward ; all the dorsal processes are small and inconspicuous.

The arms are from twenty-five to thirty in number, and about 50 mm. in length ; III Br series are always present on some or all of the rays.

*Type Locality.* 'Siboga' Station No. 49 a ; Sapeh Strait, between Sumbava and Komodo, Sunda Islands ; 69 metres.

*Decametra mylitta*, sp. n.

This new form is nearest to *D. mollis* from Kurrachi, but the cirri are slightly stouter, the majority of the segments being twice as broad as long or even somewhat broader instead of only slightly broader than long as in *D. mollis*, and the proximal pinnules, while of about the same proportions, are relatively longer and stouter and are composed of somewhat shorter segments.

The centrodorsal is discoidal, the flat dorsal pole being 1.5 mm. in diameter ; the cirrus sockets are arranged in two closely crowded alternating marginal rows.

The cirri are XIX, 20-23, 10 mm. or 11 mm. long : the cirrus segments are subequal in length and all short ; the first is very short, the second slightly longer, the third and following about twice as broad as long or slightly broader ; the last three before the penultimate increase slightly in length, so that the antepenultimate is about one-third broader than long ; the earlier segments have the dorsal surface swollen and distally truncated, so that the dorsal profile of the cirrus is serrate ; after the first three segments the dorsal profile becomes straighter, making a considerable angle with the longitudinal axis of the cirrus, and the distal edge becomes straight, forming a very finely spinous transverse ridge, which, however, is not raised above the general surface of the segments ; this transverse ridge becomes gradually more and more marked, at the same time moving more and more toward the centre of the dorsal surface ; on the ninth segment it becomes median and begins to acquire a slightly concave profile, and after the fourteenth it resolves itself into two prominent, entirely distinct, tubercles situated side by side, the distance between their two apices being about equal to the distance from either apex to the outer edge of the segment ; distally these two tubercles gradually approach each other, and gradually move nearer the proximal margin of the segments ; on the fourth segment before the



penultimate the two tubercles fuse into a single transversely elongate tubercle, which gradually becomes less and less elongate and on the antepenultimate appears as a single small rounded tubercle situated near the proximal margin of the segment; when the cirri are viewed from the side no distinct dorsal processes are seen (though the dorsal profile is serrate) until the distal half, when the tubercles appear as low blunt dorsal spines.

$P_1$  is small and weak, 5 mm. long, with fourteen segments, tapering with moderate rapidity in the proximal half and becoming very slender distally; the first segment is short, the following gradually increasing in length and becoming about as long as broad on the fourth or fifth, and about twice as long as broad distally; the pinnule is slightly prismatic;  $P_2$  is 9 mm. long, with seventeen segments, not greatly larger than  $P_1$  basally, but tapering evenly from the base to the tip and therefore appearing stouter; the first two segments are slightly broader than those following, and are much broader than long; the third segment is slightly broader than long, the fourth is slightly longer than broad, and the following are about half again as long as broad, becoming twice as long as broad terminally; the pinnule is rounded prismatic; the fourth and following segments have slightly produced and spinous distal edges, this character gradually increasing in extent distally and being most marked along the prismatic ridge;  $P_3$  is 6 mm. long, with fourteen segments, and is similar to  $P_2$  except in size;  $P_4$  is 5 mm. long, with thirteen segments, and resembles  $P_3$ ;  $P_5$  is 4.5 mm. long, with fourteen segments, and resembles  $P_4$ , but the component segments are proportionately shorter;  $P_6$  is 4 mm. long with fifteen segments, and resembles  $P_5$ ; the following pinnules are similar to  $P_6$ ; the distal pinnules are very slender, 7 mm. long, with twenty-one segments, of which the outer are about twice as long as broad.

The ten arms are 75 mm. long.

*Type Locality.* 'Siboga' Station No. 99; anchorage off North Ubian, between Borneo and Mindanao; 16-23 metres.

*Prometra laevipinna*, sp. n.

The centrodorsal is discoidal, with a broad flat circular dorsal pole 2 mm. in diameter; the cirrus sockets are arranged in a single closely crowded marginal row.

The cirri are XIV, 18-23, 13 mm. long: the first segment is very short, the following gradually increasing in length and after the tenth or eleventh becoming about as

broad as long; the first segment has the distal dorsal edge produced; on the second and third this becomes a strong transverse ridge, which gradually moves anteriorly, becoming median on the eighth and following, and appearing as a minute median spine in lateral view; this ridge shows no tendency to resolve itself into paired spines or tubercles, nor does it narrow appreciably on the outer segments, appearing as a broad transverse ridge on the antepenultimate; the opposing spine is small, slender, median, erect, in height equal to about one-quarter of the lateral diameter of the penultimate segment.

The arms, which resemble those of the other small species of the genus, are 40 mm. long.

P<sub>1</sub> is 5.5 mm. long, with fourteen or fifteen segments, moderately slender and somewhat stiffened; the first segment is short, the following gradually increasing in length, so that the fifth is about as long as broad and the outer very slightly longer than broad; from the third segment outward the pinnule is rather strongly prismatic, with a prominent rounded ridge running along the centre of the outer surface; P<sub>2</sub> is 6.5 mm. long, with seventeen segments, resembling P<sub>1</sub>, but slightly more slender basally and tapering more evenly to the tip, and not so strongly prismatic; P<sub>3</sub> is 4.5 mm. long, with fourteen segments, similar to the preceding, but proportionately smaller, and more slender distally; P<sub>4</sub> is 3.5 mm. long, with thirteen segments, small and slender, with the outer segments twice as long as broad; P<sub>5</sub> is similar, 3 mm. long, with eleven or twelve segments; P<sub>6</sub> resembles P<sub>5</sub>; the distal pinnules are very slender, 7 mm. long, with from twenty to twenty-two segments; the outer edges of the segments of the earlier pinnules are perfectly smooth.

*Type Locality.* Saleyer (north of Flores).

*Prometra minima*, sp. n.

The centrodorsal is thin discoidal, with a flat finely papillose dorsal pole 1 mm. in diameter.

The cirri are X, 10-12, 3 mm. to 4 mm. long: the first segment is short, the following gradually increasing in length, so that the fifth or sixth and following are about as long as broad; the second and following have a finely serrate transverse ridge, which becomes median after the fourth or fifth; this transverse ridge is low and very narrow, appearing as a very minute sharp spine in lateral view; on the second, third, and fourth segments the lateral angles of this ridge

project beyond the profile of the cirrus as seen in dorsal view, but beyond the fourth segment the ridge becomes narrower, beyond the sixth dividing more or less completely into two transversely oblong sharp ridges or small sharp spines; the antepenultimate segment possesses a single dorsal spine; the opposing spine is much larger than the preceding dorsal processes.

The radials are just visible beyond the centrodorsal; the  $IBr_1$  are very short, about four times as broad as long, the proximal and distal edges parallel, the lateral edges slightly convergent; there are slight rounded ventrolateral projections; the axillaries are broadly pentagonal, half again as broad as long, with slight rounded ventrolateral processes resembling those on the  $IBr_1$ ; the synarthrial tubercles are moderately developed.

The ten arms are very slender, 35 mm. to 40 mm. long, and resemble those of the other species of the genus; there is a faintly indicated rounded median carination on the lower oblong brachials.

$P_1$  is 2 mm. long, with eight or nine segments, nearly as stout basally as  $P_2$ , but tapering more rapidly and becoming slender and delicate distally; the first segment is short, the following gradually increasing in length and becoming slightly longer than broad on the third and about twice as long as broad distally; the distal edges of the outer segments are slightly spinous;  $P_2$  is 3 mm. long, stiff and spine-like, though slender, tapering slowly and evenly from the base to the tip, with eight or nine segments, of which the first is twice as broad as long, the second is nearly as long as broad, the third is nearly twice as long as broad, and the remainder are about three times as long as broad; the pinnule is rather strongly prismatic, and the distal edges of the third and following segments bear long and prominent spines on the prismatic angles;  $P_3$  is 2 mm. long, with eight segments, of which the distal are considerably elongated, small and slender, slightly stiffened;  $P_4$  is 1.25 mm. long, very delicate, and not stiffened, with nine segments, of which the distal are much elongated;  $P_5$  is similar, but slightly shorter; the distal pinnules are 2.5 mm. long, with thirteen segments, of which the second and third are strongly carinate and the outer are very greatly elongated.

*Type Locality.* 'Siboga' Station No. 117; entrance to Kwandang Bay, Celebes; 80 metres.

*Prometra parva*, sp. n.

The cirri are XIV, 14-15, 5.5 mm. long, and resemble

those of *P. minima*; the sixth or seventh and following segments are about as long as broad.

The ten arms are 40 mm. long; the lower discoidal brachials are smooth, but those following have rather strongly everted distal ends.

$P_1$  is 2·3 mm. long, with eleven segments; it tapers rather rapidly in the first four segments, more gradually from that point onward; the first segment is short, the second slightly longer, the third slightly broader than long, the fourth slightly longer than broad, the fifth and following about twice as long as broad;  $P_2$  is from 3·5 mm. to 4·5 mm. long, with eleven segments, evenly tapering, much larger and stouter than the other pinnules, though not greatly enlarged; the first segment is short, the second half again as broad as long, the third slightly broader than long, the following gradually increasing to the seventh, which, with the following, is twice as long as broad; the pinnule is rather strongly prismatic and the fourth and following segments have their distal edges produced on the prismatic angles into prominent short stout spines, which increase in prominence distally;  $P_3$  is 1·5 mm. long, with eight segments, of which the distal are elongated, small and weak;  $P_4$  is slightly smaller than  $P_3$ ; the distal pinnules are exceedingly slender, 4 mm. to 4·5 mm. long, with thirteen segments, of which the second and third are slightly carinate and the outer are greatly elongated.

*Type Locality.* 'Siboga' Station No. 315; anchorage off Sailus Besar, Paternoster Islands; up to 36 mètres.

*Oligometra marginata*, sp. n.

This new species is most closely related to *O. adeonæ*.

The dorsal pole of the centrodorsal is papillose.

The cirri are XV, 15-16, 7 mm. long: the first segment is short, the following gradually increasing in length, so that the fourth, fifth or sixth, and following are about as long as broad; the third and following segments have a strong transverse ridge near the proximal dorsal margin; this ridge is prominent and high with a finely serrate crest; it lies about one-third of the distance between the proximal and distal margins of the segments; in the proximal half or three-quarters of the cirri the distal dorsal edge of the segments is more or less everted, so that there is the same bidentate appearance characteristic of the cirri of *O. adeonæ*; on the earlier segments this eversion may be nearly as high as the transverse ridge, but it soon decreases in height and



disappears entirely in the outer half or quarter of the cirri; the smaller cirri are quite without it.

The ten arms are 30 mm. long; the proximal arm structure is the same as that of *O. adeonæ*; the ossicles of the IBr series and the first two brachials are broad and are in lateral contact through produced and flange-like ventrolateral borders, the outer edges of which are parallel to the longitudinal axes of the segments which bear them.

$P_1$  is 5 mm. long, with nine segments, rather slender but considerably stiffened, recalling  $P_2$  in the more delicate varieties of *Stephanometra monacantha*; the first segment is about one-third broader than long, the second half again as long as the proximal width, slightly trapezoidal, the third about three times as long as its proximal diameter, the fourth to the sixth slightly longer, the following rapidly diminishing to the small terminal segment; the second to the fourth segments are slightly constricted centrally;  $P_2$  is 4 mm. long, with nine segments, similar to  $P_1$ , but very slightly stouter and with slightly shorter segments;  $P_3$  is 2.5 mm. to 3 mm. long, with eight segments, more slender and less stiffened than the preceding;  $P_4$  is 2 mm. long, small, slender, and weak, with eight or nine segments; the next two pinnules are similar to  $P_4$ ; the following gradually become elongated, the distal pinnules being from 4.5 mm. to 5 mm. in length, with thirteen segments, of which most are from two to three times as long as broad and very slender.

*Type Locality.* 'Siboga' Station No. 305; mid-channel of Solor Strait, off Kampong Menanga; 113 metres.

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#### IV.—Mammals from the Ja River, Cameroons.

By OLDFIELD THOMAS.

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##### *Kerivoula cuprosa*, sp. n.

A small speckled brown species with short incisors.

Size decidedly less than in the related species *K. arosa* and *lanosa*. Fur soft and fine (hairs of back 6–6.5 mm. in length), extending on to the forearm, thinly along the pollex and terminal part of the third digit, and down the upper side of the legs on to the feet; proximal part of interfemoral thinly haired, naked distally, the hinder margin with a

number of fine hairs not forming a fringe; under surface of legs and interfemoral nearly naked. General colour above dark bistre-brown, the tips of many of the hairs conspicuously contrasted silvery buff, those on the forearms, rump, and hind limbs more ochraceous buff; under surface duller brown, the bases of the hairs dark slaty, the tips of some of the hairs whitish.

Ears of medium length, anterior border strongly convex, posterior with a sharp concavity just below the tip. Tragus long, curved outwards, its base with a small lobule externally succeeded above by an emargination.

Upper incisors unusually short, their enamel-covered portion but little longer than the projecting part of their root, the inner one bicuspid, its posterior cusp as thick as and half the height of the anterior. Outer incisor also bicuspid, owing to its basal ledge being raised up postero-internally as a second cusp half the height of the main cusp. Middle premolar about two-thirds the height and area of the anterior one. Outer lower incisors tricuspid, the outer cusps half as large as the median one. Middle lower premolar rather smaller than the subequal first and last.

Dimensions of the type (the starred measurements taken in the flesh by the collector):—

Forearm 32 mm.

Head and body \*45; tail \*45; ear \*13·5; tragus on inner edge 5·5; third finger, metacarpal 31, first phalanx 15; lower leg and foot (c. u.) 21.

Front of upper canine to back of  $m^3$  5·1; front of lower canine to back of  $m_3$  5·5.

*Hab.* Bitye, Ja River, S.E. Cameroons. 2000'.

*Type.* Adult male. Original number 564. Collected 17th October, 1911, by Mr. G. L. Bates.

This well-marked species resembles *K. arosa* in colour, but is much smaller, the forearm of that animal being 37 mm. in length. By the characters used in Dobson's synopsis it comes nearest to *K. lanosa*, but differs both by size and colour, and, as from every other, by its peculiarly short and deeply bicuspitate upper incisors. At Bitye Mr. Bates also obtained the little *K. muscilla* and an additional specimen of *K. smithii*, described by me in 1880. The latter is slightly larger than *K. cuprosa* and has practically unicuspid outer lower incisors.

*Colomys bicolor*, sp. n.

Larger and darker coloured than *C. goslingi*.

Size decidedly greater than in *C. goslingi*, as shown by

skull-dimensions. Coloration similarly conspicuously bicolor, but the line of demarcation slightly lower, so that the dark colour encroaches a little on the forearms, instead of these being wholly in the white area. General colour above between cinnamon and bistre, the back more heavily blackened than in *goslingi*. White patch at outer base of ear smaller than in *goslingi*. Arms and hands white except for a narrow extension of the dorsal colour downwards from the shoulder to the middle of the forearms. Feet greyish flesh-colour. Tail blackish above, whitish below, the difference not conspicuous. Mammæ apparently  $2-1=6$ .

Skull similar in all essentials to that of *C. goslingi*, but larger throughout. Nasals longer. Interorbital region narrower, its edges more rounded. Brain-case longer and higher. Palatal foramina with the peculiar expansion on the septum, previously described, so developed as to touch, on one side, the outer wall of the foramen, and so isolate completely its posterior end.

Dimensions of the type (measured in the flesh):—

Head and body 143 mm.; tail 175; hind foot 39; ear 21.

Skull: greatest length 36; condylo-incisive length 32·8; nasals 14·2; interorbital breadth 4·5; breadth of brain-case 15·2; palatilar length 16·7; diastema 10·2; palatal foramina  $7·3 \times 3·2$ ; upper molar series (worn down and contracted) 5·2.

*Hab.* Bitye, Ja River, S.W. Cameroons (West Congo drainage area). Alt. 2000'.

*Type.* Old female. Original number 569. Collected 23rd October, 1911, by Mr. G. L. Bates.

The smaller species, *C. goslingi*, Thos. & Wrought., was found on the Welle River, so that the genus is evidently widely distributed in the Congo area.

### *Epimys æta*, Thos.

Mr. G. L. Bates has sent from Bitye some further examples of this distinct little species, and these show that the type had by no means attained its full size, especially as regards its skull. The following measurements of a fully adult female are therefore worthy of record:—

Head and body 93 mm.; tail 120; hind foot 18; ear 14·5.

Skull: greatest length 26; condylo-incisive length 24·2; zygomatic breadth 13·5; nasals 8·7; interorbital breadth 4·5; breadth of brain-case 12·3; palatilar length 11·6; diastema 7·6; palatal foramina  $5·2$ ; upper molar series 4·3.

V.—*Small Mammals from South America.*

By OLDFIELD THOMAS.

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*Leontocebus midas egens*, subsp. n.

General characters of true Guianan *midas*, but back more strongly suffused with dark buffy, generally throughout, and in all cases across the shoulders. Black of the head less deep and less continued down on to the back, the grizzled buffy of the back going further forward on the nape. Hands, instead of being wholly "ochraceous" or "ochraceous buff," only of this colour on the outer half of the wrist, the metacarpus and digits being decidedly lighter coloured, "buff" or "cream-buff." Feet also rather lighter than in *midas*, though the difference is less conspicuous.

Dimensions of the type (measured in the flesh):—

Head and body 229 mm.; tail 384; hind foot 65; ear 40.

Skull: greatest length 49.5.

*Hab.* Obidos, Lower Amazons.

*Type.* Adult female. B.M. no. 12. 5. 11. 5. Original number 58. Collected 15th February, 1912, by Fräulein Dr. E. Snethlage; presented by the Goeldi Museum, Para. Five specimens examined.

This Amazonian form of the common yellow-handed marmoset is closely similar to the typical Guianan animal, but may be distinguished by the paler colour of its hands, a difference verified on five examples of *egens* as compared with ten of *midas*. Curiously enough, two specimens from the Moon Mountains, the nearest locality in Guiana to Obidos, have hands of an even darker tone than those of British Guiana, and resemble in this respect one from Cayenne which I have always considered to represent Geoffroy's *rufimanus*.

*Felis pardinoides emerita*, subsp. n.

General characters of *F. pardinoides*, including size, the backward direction of the nape-hairs, and the general coloration. But the feet, both fore and hind, instead of being blackened below, as is usual in the majority of cats, are not or scarcely darker below than above, where they are of a uniform "clay-colour"; the heel alone is blackish, as in the allied forms. White ear-patches larger than in *pardinoides*



and *p. andina*. Black nuchal stripes strongly marked in the two males, narrow and discontinuous in the female.

Skull on the whole with a rather less swollen brain-case than in true *pardinoides* and in *F. p. andina*. Postorbital processes directed rather more outwards, less slanted backwards. Bullæ smaller than in *pardinoides*, only one of the four specimens having them as large as in the type of *andina*, which in turn has them smaller than in S.-Brazilian *pardinoides*. Teeth about as in *pardinoides*, smaller than in *andina*.

Dimensions of the type (an adult female):—

Head and body 480 mm.; tail 330; hind foot 98.

Skull: greatest length 85; condylo-basal length 81.3; zygomatic breadth 5.5; interorbital breadth 14.2; breadth of brain-case 40; palatal length 31; front of canine to back of  $p^4$  23.3; length of  $p^4$  on outer edge 9 (10.1 in ♂).

*Hab.* Northern Venezuela. Type from the "Montes de la Culata," Merida (alt. 3000 m.); another specimen (melanistic) from Tachira.

*Type.* Adult female. B.M. no. 5. 7. 5. 3. Collected 14th April, 1904, by S. Briceño. Two males and another female also in collection.

The pale colour of the hairy part of the palms and soles of this cat is an unusual character, and I have considered the possibility of its having been artificially produced by the limbs having been dipped in some preservative. But there are four specimens, collected at considerable intervals of time, all with their feet similarly coloured, so that so uniform an alteration seems unlikely. In any case, however, on account of the skull-characters described above and its comparatively large ear-patches, the Merida wild cat would be subspecifically separable from its allies elsewhere.

### *The Grisons of Chili and Argentina.*

In 1907 \* I showed that the name *vittatus*, which had been commonly used as a "blanket-name" for Grisons from all parts of South America, was based on a specimen from Surinam, and was therefore no doubt applicable to one of the larger forms of the genus, like *G. allamandi* and others, and I then gave the specific name of *furax* to the "Furão" of S. Brazil and the Argentine, which is not only smaller than the members of the *vittatus* group, but is distinguished by having no inner cusp on the lower carnassial tooth.

\* Ann. & Mag. Nat. Hist. (7) xx. p. 163 (1907).

Further consideration induces me to think that this latter character might be made the basis of a subgeneric division of *Grison*, and that the species without the cusp should form a special subgenus, which might be called *Grisonella* and have *G. furax* as its type.

In Chili, instead of there being only one form of *Grison* present, it now appears there are two, a larger and a smaller, the former inhabiting Central Chili and the latter South Chili, whence three specimens have been sent to the British Museum by Messrs. Bullock and Saldanha. The question therefore arises as to which of these animals should bear the specific names *cuja* and *quiqui* given to members of this genus by Molina, and also that of "*var. chilensis*" assigned by Nehring\* in rather a casual way to a skull from "Chili."

The specimens received from S. Chili (Temuco) are marked as being called "*Cuya*" by the natives; and since Molina said his "*Mustela cuja*" was of the size of a ferret, which suits the Temuco *Grison* very well and the large Central Chili one not at all, I propose to identify the *cuja* as being this animal, whose name would therefore be *Grison* (*Grisonella*) *cuja*, Mol.

And further, Molina's *Mustela quiqui* can hardly be otherwise than the same animal, for it is said to be a weasel ("*donnola*") about 13 inches in length from nose to base of tail, and while a female *G. cuja* measures 13 and a male 15 inches in length, the Central Chili species attains not less than 17 inches in the female and up to 24 in the male †.

Nehring's *chilensis* is unquestionably a female of the small species (basilar length of skull 58 mm.).

A male skull of this species is 70 mm. in condylo-basal length, and a female 64.5.

All three Chilean names being therefore applicable to the smaller species of S. Chili, the question arises as to what the name of the larger Central Chili species should be.

Careful comparison, however, shows that this animal cannot be distinguished from the Argentine "*Huron*," which has been hitherto considered the same as the Brazilian *G. furax*.

But the latter is a much more buffy-coloured animal than

\* Zool. Jahrb. Syst. i. p. 189 (1886).

† Not knowing that a small species of *Grison* occurred in S. Chili, Burmeister ('La Plata,' iii. p. 160) supposed that the Quiqui was the young of the ordinary "*Huron*." But Molina gave a general account of its habits, evidently knowing the species well, while as to the number of its teeth the frequent loss of  $p^1$  and  $m_2$  makes specimens with only twenty-eight teeth by no means rare.

that inhabiting Chili and the Argentine, to which therefore a special subspecific name might be given.

I would propose to call it

*Grison furax melinus*, subsp. n.

Size as in *G. furax*, considerably larger than in *G. cuja*.

General colour dark greyish, the light ends to the hairs nearly white instead of being buffy as in *furax*; light frontal band cream-buff, this being "buff" or deeper in *furax*.

Dimensions of the type (measured in flesh):—

Head and body 475 mm.; tail 180; hind foot 60.

Skull: condylo-basal length 80·5; zygomatic breadth 46\*.

An older male from the same locality measures 83·5 in condylo-basal length and one from Mar del Plata, Argentine, 84·6.

*Hab.* Chili, between about 30° and 36° S. lat., and Argentina from Tucuman to Chubut. Type from Quillota, near Valparaiso.

*Type.* Adult male. B.M. no. 1. 6. 8. 1. Original number 191. Collected 5th April, 1901, and presented by John A. Wolffsohn, Esq.

The Museum is indebted to Mr. Wolffsohn for four skins and six skulls of this animal.

*A Second Specimen of Glironia venusta.*

Through the kindness of Dr. K. Kraepelin, of the Hamburg Museum, the British Museum has been allowed to acquire by exchange an example of *Glironia* from Yungas, Bolivia, which had been in the Hamburg Museum for some years, having been purchased from Rolle in 1897.

The specimen is an immature male in spirit, and by its help I am enabled to correct some inaccuracies in my original account of *Glironia* † and to add some further information about it.

The spirit-specimen shows that the tail is more distichous than appeared on the skin and that the middle line of the underside, instead of being naked only for its terminal three inches, is very thinly hairy from close to the base and becomes practically naked about halfway along.

In the skull some at least of the unusual lowness is due to the deteriorated condition of the type, the form of the brain-

\* Other measurements given by Nehring, *l. c.* p. 209.

† *Ann. & Mag. Nat. Hist.* (8) ix. p. 239 (1912).

case in the fresh specimen not being materially different from that in *Marmosa*.

The tooth-characters are all as described in the type, and it may be noted in addition that the upper milk-secator is narrower than in *Marmosa*, and has its inner lobe further back, the tip of the lobe being behind the level of the anterior main cusp, while it is in front of it in *Marmosa*.

Allowing for the difference in age, I can see no reason to suppose that the Yungas specimen is specifically distinct from that from Pozuzo.

# VI.—Notes on *Fossorial Hymenoptera*.—IX.

By ROWLAND E. TURNER, F.Z.S., F.E.S.

## *On some new Species from the Australian and Austro-Malayan Regions.*

### Family Thynnidæ.

#### *Agriomyia cornuticollis*, sp. n.

♀. Nigra; pygidio flagelloque testaceo-brunneis, calcariis pallidis; pronoto subconcavo, angulis anticis tuberculatis, posticis spina erecta armatis.

Long. 8 mm.

Head very thin and almost flat, more than half as broad again as long, rounded at the posterior angles, more than twice as broad as the thorax. Pronotum broader anteriorly than long, narrowed posteriorly, slightly concave, strongly raised and tuberculate at the anterior angles, armed with an erect acute tubercle on each side close to the posterior angles, the posterior margin arched, the angles acute. Scutellum narrow; median segment shorter than the pronotum, broadened posteriorly and obliquely sloped. Shining, the head finely aciculate, thorax and abdomen with a few fine scattered punctures. First dorsal segment broadly depressed at the apex, the raised basal portion broadly and rather shallowly emarginate at the apex. Second dorsal segment with five well-defined transverse carinæ, including the raised apical margin; pygidium lanceolate. Ventral segments more strongly punctured, the fifth closely and coarsely punctured.

*Hab.* Hermannsburg, Central Australia (*H. J. Hillier*).

This female is easily distinguished by the peculiar form of the pronotum.



## Genus THYNNOTURNERIA, Rohw.

*Æolothynnus*, Turn. Wystman's Gen. Insect. cv. p. 39 (1910).*Turnerella*, Rohw. Ent. News, xxi. p. 349 (1910).*Thynnoturneria*, Rohw. Ent. News, xxi. p. 474 (1910).*Eurohweria*, Turn. Ann. & Mag. Nat. Hist. (8) vii. (1911).

I am by no means sure that the name *Æolothynnus* should not be used for this genus. Ashmead in describing the genus *Æolothynnus* took an undescribed species for the type. In my work on the Thynnidae I accepted Ashmead's genus, but treated the species as a *nomen nudum*. Mr. Rohwer, on the other hand, holds that the description of the genus covers the species also; but I cannot agree with this opinion, as Ashmead evidently did not intend the description for a specific one, and a description to be recognized should be at least intended by the author for a description of a species. In some parallel cases Ashmead has actually marked the species name as MS. Unfortunately *A. cerceroides*, Sm., selected by me as the type of the genus, does not appear to belong to the same genus as Ashmead's type. Yet if Ashmead's specific name is treated as a *nomen nudum*, *A. cerceroides* must be treated as the type of the genus. It is bad enough to have to recognize the very insufficient descriptions of some authors as valid, but if we are also to accept what were never intended for descriptions things would be still worse. For the present, pending some decision on the subject, I am using Rohwer's name, but do not consider that it can stand. The whole confusion is due to a want of editing in Ashmead's paper, as no editor should publish a description of a genus with an undescribed species taken for the type.

*Thynnoturneria trimaculata*, sp. n.

♂. Niger; femoribus, tibiis segmentisque abdominalibus sexto septimoque rufo-ferrugineis; clypeo apice lateribusque, pronoto marginibus, mesonoto macula elongata, scutello macula, post-scutello, segmentis dorsalibus 1-5 fascia curvata utrinque maculaque bilobata mediali, segmentisque ventralibus 2-5 macula utrinque pallide flavis; alis hyalinis, venis nigris, stigmatibus testaceo.

Long. 9 mm.

Clypeus strongly convex, longer than the greatest breadth, truncate at the apex, with a low and rather indistinct longitudinal carina near the apex. Interantennal prominence not well defined; antennæ shorter than the thorax without the median segment, the flagellum of about even

thickness throughout. Head and thorax finely and closely punctured, the abdomen more sparsely punctured, pubescence greyish and short. Pronotum broadly emarginate on the anterior margin; scutellum moderately convex; median segment steeply sloped posteriorly, but not truncate. Abdomen narrow, the segments strongly constricted at the base; sixth ventral segment with a spine on each side at the apical angles; hypopygium ending in three long slender spines, the median spine nearly twice as long as the lateral ones. Second abscissa of the radius longer than the third by about one-quarter; first recurrent nervure received by the second cubital cell a little beyond two-thirds from the base, second received by the third cubital cell at about one-tenth from the base; the division of the first cubital cell by the branch nervure represented by a scar only,

*Hab.* Hermannsburg, Central Australia (*H. J. Hillier*).

*Thynnoturmeria centralis*, sp. n.

♂. Niger; mandibulis basi, clypeo lateribus, maculis duabus supra antenas, pronoto marginibus, postscutello, mesopleuris macula antice, segmento mediano macula apicali utrinque, segmentis dorsalibus 1-4 macula obliqua utrinque pallide flavis; mesonoto, scutello, mesopleuris segmentisque abdominalibus 5-7 rufo-ferrugineis; pedibus fusco-ferrugineis, flavo-variegatis; alis hyalinis, venis fuscis, stigmatibus ferrugineo.

Long. 9 mm.

Clypeus convex, as long as the greatest breadth, truncate at the apex, connected by a narrow carina with the inter-antennal prominence, which is not strongly raised. Head thin, finely and closely punctured; antennae as long as the thorax without the median segment, of even thickness throughout. Anterior margin of the pronotum straight, not emarginate. Thorax and abdomen more sparsely punctured than the head, the sides of the scutellum smooth and shining. Scutellum rather broadly truncate at the apex, with a depressed transverse line at the base. Median segment rather short, sloped posteriorly, not truncate. Abdominal segments narrower than the thorax, strongly constricted at the base; a short spine on each side at the apical angles of the sixth ventral segment; hypopygium with three spines, the apical one much longer than the lateral, which are short and slight. Second abscissa of the radius longer than the third; first recurrent nervure received at three-fifths from the base of the second cubital cell, second at one-sixth from the base of the third cubital cell.

*Hab.* Hermannsburg, Central Australia (*H. J. Hillier*).

*Zaspilothynnus biroï*, Turn.*Thynnus biroï*, Turn, Ann. Mus. Nat. Hung. p. 117 (1910). ♂.*Zaspilothynnus biroï*, Turn. Ann. & Mag. Nat. Hist. (8) vii. p. 302 (1911). ♂.Subsp. *pratti*, subsp. n.

♂. Differs from the typical form in the narrower hypopygium, and in the greater development of the yellow markings.

*Hab.* Faefac, S.W. New Guinea. Ex coll. Perkins.

The typical form is from N.E. New Guinea. The female is still unknown.

Family *Psammocharidæ* (olim *Pompilidæ*).*Pseudagenia camilla*, Turn.*Pseudagenia camilla*, Turn. Proc. Zool. Soc. p. 312 (1908). ♀.

This is the Australian representative of *P. nasuta*, Sm. It differs from the typical form from Celebes in the greater distance between the eyes on the vertex and in the lesser length of the third cubital cell on the radial nervure.

*Pseudagenia faustina*, sp. n.

♀. Nigra; antennis aurantiacis; tibiis tarsisque anterioribus fulvis; alis hyalinis, fusco bivittatis.

♂? Niger; gracilis; antennis aurantiacis, apice infuscatis; tibiis tarsisque anterioribus fulvis; clypeo apice oculorumque margine interiore angustissime flavis; alis hyalinis fusco leviter bivittatis.

Long., ♀ ♂, 9 mm.

♀. Clypeus broadly rounded at the apex. Antennæ longer than the head, thorax, and median segment combined; the second joint of the flagellum as long as the first and third combined. Eyes separated on the vertex by a distance nearly equal to the length of the second joint of the flagellum; the posterior ocelli more than half as far again from the eyes as from each other. Front finely rugulose; vertex, thorax, and median segment opaque; abdomen slightly shining. Posterior margin of the pronotum with a distinct angle in the middle; median segment slender, fully half as long again as broad, with a wide but shallow groove from base to apex, the sides of the groove slightly raised and forming low carinæ, the sides of the segment sloping. First abdominal segment petiolate, the petiole occupying the basal third of the segment, the apical two-thirds gradually

widened, the apex half as broad as the apex of the second segment. Sixth segment triangular, pubescent. Second abscissa of the radius a little longer than the third, which is twice as long as the first, the third transverse cubital nervure curved outward. First recurrent nervure received at two-thirds from the base of the second cubital cell, second close to the middle of the third cubital cell. Cubital nervure reaching about halfway from the third cubital cell to the margin of the wing; submedian cell a little longer than the median; cubitus of hind wing originating beyond the transverse median nervure.

The fuscous band on the basal nervure is irregular, the second fuscous band occupies the basal half of the radial cell, the second and third cubital cells, reaching into the discoidal cell. Posterior tibiae smooth; tarsal unguis with one small tooth near the middle, the pulvillus rather small, shorter than the unguis.

*Hab.* Mackay, Queensland; November. Ex coll. Turner.

The probable male of this species has the clypeus broadly subtruncate at the apex; the antennae stouter and rather shorter than in the female, but still longer than the head, thorax, and median segment combined, the second joint of the flagellum scarcely longer than the third; the eyes separated on the vertex by a distance equal to the length of the second joint of the flagellum plus half the length of the third joint; the median segment flatter than in the female, the median groove narrow and only on the basal half; the basal segment of the abdomen slender, less than half as wide at the apex as the second segment. The third abscissa of the radius is a little longer than the second; the first recurrent nervure is received close to the middle of the second cubital cell, the second before one-third from the base of the third cubital cell. The sixth ventral segment has the lateral margins elevated, most strongly at the base, and a well-defined median carina. The calcaria are whitish. The fuscous fasciae of the fore wings are less extensive than in the female. It is with much doubt that I associate the sexes in this species, there being considerable differences in the neuration and sculpture.

*Pseudagenia claudia*, sp. n.

♀. Nigra; opaca; alis fusco leviter bivittatis; scapo subtus fusco-testaceo; tarsis anticis fusco-brunneis.

Long. 7 mm.

♀. Clypeus broadly subtruncate at the apex, more than



twice as broad as the greatest length. Antennæ about as long as the head, thorax, and median segment combined, the second joint of the flagellum as long as the first and third combined; the frontal prominence at the base of the antennæ very slightly developed. Eyes separated on the vertex by a distance equal to the length of the second joint of the flagellum plus two-thirds of the third joint; the ocelli in an equilateral triangle, the posterior pair much further from the eyes than from each other. Pronotum very widely arched posteriorly, without an angle in the middle. Median segment slightly convex, with a median groove from the base, becoming less distinct towards the apex, broader at the base than long, narrower at the apex, more opaque than the thorax and with a little short whitish pubescence at the angles. Petiole of the first abdominal segment very short, occupying less than one-quarter of the total length of the segment, which is no longer than the second segment; sixth dorsal segment punctured sparsely at the base, smooth and narrowly rounded at the apex; the abdomen opaque and slightly pruinose. Second abscissa of the radius distinctly shorter than the third, scarcely longer than the second transverse cubital nervure; first recurrent nervure received a little before the middle of the second cubital cell, second before one-quarter from the base of the third cubital cell. Submedian cell a little longer than the median; cubitus of the hind wing originating just beyond the transverse median nervure. Cubitus of the fore wing reaching beyond the third cubital cell, more than halfway to the outer margin of the wing. An irregular fuscous band along the basal nervure, another filling the second cubital cell and extending to the base of the radial and apex of the discoidal cell.

*Hab.* Mackay, Queensland (*Turner*); March and April.  
2 ♀ ♀.

*Pseudagenia fabia*, sp. n.

♀. Nigra, obscure viridescens; alis subhyalinis, iridescentibus, fusco-bivittatis, fascia basali angusta, apicali lata.  
Long. 6 mm.

♀. Clypeus short, about three times as broad as long, broadly truncate at the apex. Antennæ about as long as the head, thorax, and median segment combined; the second joint of the flagellum as long as the first and third combined. Eyes separated on the vertex by a distance about equal to the combined length of the first and second joints of the

flagellum ; the front without tubercles above the base of the scape. Pronotum broadly arched posteriorly, without an angle in the middle. Median segment a little longer than the breadth at the base, a little narrowed towards the apex, convex, the median sulcus obsolete at the base, faintly indicated towards the apex. First abdominal segment gradually widened from the base, without a distinct petiole, no longer than the second. Second abscissa of the radius shorter than the third, first transverse cubital strongly oblique, second straight, third curved outward in the middle and as long as the third abscissa of the radius. First recurrent nervure received before the middle of the second cubital cell, second beyond the middle of the third cubital cell. Submedian cell a little longer than the median ; cubitus of the hind wing originating far beyond the transverse median nervure. Cubitus of the fore wing reaching about halfway from the third cubital cell to the margin of the wing. The fuscous band along the basal nervure is regular but not broad ; the second fuscous band is of almost even breadth, extending from the base of the stigma to the apex of the radial cell and reaching the lower margin of the wing. The whole insect is subopaque and glossed with dull bluish green.

*Hab.* Kuranda, Queensland (*Turner*) ; November.

Allied to *P. una*, Turn.

### Family Crabronidæ.

#### Subfamily PEMPHREDONINÆ.

#### *Psenulus* (?) *scutellatus*, sp. n.

♀. Nigra, nitida ; mandibulis basi, scapo, scutello fascia apicali, postscutello, pedibus anticis et intermediis, tibiisque posticis basi flavis ; tegulis fusco-testaceis ; alis hyalinis, venis nigris. Long. 8 mm.

Clypeus covered with shining white pubescence, the apex almost truncate. An elevated carina between the antennæ, joining a low arched carina below the base of the antennæ ; a distinct groove reaching from the anterior ocellus to the base of the interantennal carina. Flagellum thickened gradually towards the apex, the second joint as long as the first and third combined. Posterior ocelli a little further from the eyes than from each other. Pronotum distinctly raised ; the mesonotum very minutely punctured ; a transverse, deeply punctured groove at the base of the scutellum. Median segment finely punctured and pubescent on the

sides, a striated transverse groove at the base and a median groove from the base to the apex. Abdomen shining, petiolate; the basal three-fifths of the first segment linear, the apical two-fifths gradually broadened and slightly swollen, the whole basal segment about twice as long as the posterior femur. Third abscissa of the radius nearly twice as long as the second, but a little shorter than the first; the first recurrent nervure received by the second cubital cell at about one-seventh from the base; the second received by the third cubital cell close to the base, almost interstitial with the second transverse cubital nervure. Cubitus of the hind wing originating beyond the transverse median nervure.

*Hab.* Cairns, Q. (*R. C. L. Perkins*).

Related to *P. interstitialis*, Cam., which occurs in the same locality, but the colour is very different, and the position of the recurrent nervures is also different. Neither species is very nearly related to true *Psenulus*.

#### AUSTROSTIGMUS, gen. n.

Somewhat intermediate between *Stigmus* and *Harpactophilus*; from the former of which it differs in having the abdomen subsessile, not petiolate, in the smaller stigma, the longer and narrower first cubital cell; from the latter in the slenderer build, in the distinct transverse, angulated pronotum, the longer front with distinct carinæ along the inner margins of the eyes, and the recurrent nervure which is received considerably before the apex of the first cubital cell.

Type of the genus *A. queenslandensis*, Turn.

#### *Austrostigmus queenslandensis*, Turn.

*Stigmus queenslandensis*, Turn. Proc. Zool. Soc. London, p. 457 (1908).

#### *Austrostigmus reticulatus*, sp. n.

♂. Niger; antennis ochraceis; mandibulis, scapo subtus pedibusque flavis; tegulis testaceis; alis hyalinis, iridescentibus, venis testaceis; mesonoto reticulato.

Long. 4 mm.

♂. Eyes distinctly divergent towards the clypeus, separated at the base of the antennæ by a distance equal to about twice the length of the scape; clypeus narrowly produced in the middle and subemarginate on the apical margin, with a median carina from the base. Flagellum

about twice as long as the scape. A narrow groove with a marginal carina along both the inner and outer margins of the eyes; the front opaque, with a median carina almost reaching the anterior ocellus, the region round the ocelli and the vertex reticulate. Posterior ocelli a little further from the eyes than from each other. Pronotum transverse, sharply produced outwards and forwards at the anterior angles; mesonotum and the upper half of the mesopleuræ coarsely reticulate; scutellum sparsely punctured, with a transverse row of deep closely set punctures a little before the apex; median segment strongly margined, with two longitudinal carinæ near the middle from the base to the apex and two oblique carinæ on each side, the space between the carinæ obliquely striated, the posterior truncation of the segment abrupt and transversely rugulose. Abdomen subsessile, smooth and shining. Second cubital cell subtriangular, almost pointed on the radial nervure; recurrent nervure received at about five-sixths from the base of the first cubital cell. Cubitus of the hind wing interstitial with the transverse median nervure. Radial cell of the fore wing lanceolate.

*Hab.* Cairns District, Queensland (*F. P. Dodd*).

Easily distinguished from *queenlandensis* by the broader face and the coarse sculpture of the mesonotum.

This genus is connected with *Harpactophilus* by *H. tricolor*, Turn., which has the slender form and the transverse pronotum of the present genus; and with *Spilomena* by *S. australis*, Turn.

### Subfamily *SPHECINÆ*.

#### *Sphex darwiniensis*, sp. n.

♀. Nigra, mandibulis basi, scapo, tegulis, abdomine pedibusque ferrugineis; capite thoraceque albido-pilosis; alis basi flavo-hyalinis, apice late infuscatis.

Long. 20 mm.

Clypeus truncate at the apex; second joint of the flagellum half as long again as the third. Postscutellum without a sulcus or tubercles; scutellum with a shallow median furrow. Median segment with about twelve transverse carinæ, those near the base and apex lower and indistinct in the middle. First joint of the anterior tarsi with seven spines on the outer side. Petiole about as long as the third joint of the flagellum. Third abscissa of the radius shorter than the first. The pubescence on the head



and thorax is short and rather sparse; the dorsulum and scutellum bare, smooth and shining; the pleuræ indistinctly striated.

*Hab.* Port Darwin (*F. P. Dodd*). Ex coll. Perkins.

This is very near *S. rugifer*, Kohl, of which it may prove to be a local form. It differs, however, in the colour of the legs and wings and also in the number of striæ on the median segment. I have not seen typical specimens of *rugifer*.

#### Subfamily *BEMBECINÆ*.

##### *Bembex latifasciata*, sp. n.

♂. Flavo-ochraceus; flagello supra fusco, infra testaceo; vertice, mesonoto lineis tribus, linea mediana apicem haud attingente, scutello basi, segmento mediano basi, segmento dorsali primo apice et macula parva utrinque, 2-6 basi et apice, basi bilobatis septimoque basi nigris; alis hyalinis, venis basi testaceis, apice fuscis.

Long. 15 mm.

♂. Labrum not grooved, clypeus strongly convex; front distinctly carinated between the antennæ. Apical joint of the flagellum no longer than the penultimate, rather strongly curved and truncate at the apex; joints 9-11 excavated beneath, the eighth joint with a small spine beneath. Eyes almost parallel on the inner margin. Anterior and intermediate femora not dentate; anterior tarsi not dilated, with seven spines on the outer margin of the basal joint; basal joint of intermediate tarsi not dilated. First ventral segment with a stout, blunt tubercle at the base, second with a compressed prominent tubercle, sixth unarmed; seventh dorsal segment broadly rounded, shallowly subemarginate at the apex.

♀. Sixth dorsal segment very narrowly rounded at the apex, black, with a yellow spot on each side; second ventral segment rather closely punctured over the whole surface.

*Hab.* N.W. Australia, Strelley River and Roeburne.

#### Subfamily *NYSSONINÆ*.

##### *Gorytes perkinsi*, sp. n.

♀. Nigra; clypeo, fronte sub antennis scapoque flavis; flagello, pronoto, scutello, postscutello, segmento mediano macula basali utrinque, segmentis abdominalibus primo sextoque, dorsalibus tertio, quarto (basi excepta) quintoque, pedibusque aurantiacis; alis flavo-hyalinis, apice leviter infumatis.

Long. 22 mm.

Clypeus widely emarginate at the apex; eyes distinctly converging towards the clypeus. Antennæ slightly thickened towards the apex; the scape short, the second joint of the flagellum as long as the third and fourth combined. Front clothed with short fulvous-brown pubescence, slightly concave, with a distinct median sulcus reaching the anterior ocellus. Posterior ocelli a little further from each other than from the eyes. Thorax stout, opaque, sparsely punctured; the triangular area at the base of the median segment well defined, smooth and shining, with a deep median sulcus. Tibiæ stout, spinose; pulvilli rather large; basal joint of anterior tarsi with five long spines. Abdomen stout, strongly narrowed to the extremities, a little longer than the head, thorax, and median segment combined, opaque, the ventral surface slightly shining and sparsely punctured. Pygidial area gradually narrowed from the base and rather broadly rounded at the apex. Both recurrent nervures received by the second cubital cell, the first before one-quarter from the base, the second at about one-sixth from the apex, the cubital nervure sharply bent upward from the junction of the first recurrent nervure to the base of the second cubital cell; first abscissa of the radius about equal in length to the third, and four times as long as the second; first transverse cubital nervure abruptly bent outwards very near the cubital nervure, and branching inward at the bend, the branch at first clearly defined and then continued as a faint scar to the base of the stigma.

The median segment is striated on the sides near the apex and marked with dull ochraceous.

*Hab.* Cairns, Queensland (*F. P. Dodd*). Ex coll. Perkins.

This fine species is allied to *G. ciliatus*, Handl. In colour it resembles species of the genus *Abispa*, and is as large as small specimens of that genus.

#### Genus *CLYTEMNESTRA*, Spin.

I agree with Ashmead in considering that this genus is sufficiently distinct from *Gorytes*. Though almost entirely American, the following Australian species should be included:—

1. *C. duboulayi*, Turn. Proc. Zool. Soc. p. 496 (1908) (*Gorytes d.*).
2. *C. sanguinolentus*, Turn. Proc. Zool. Soc. p. 497 (1908) (*Gorytes s.*).
3. *C. lucidulus*, Turn. Proc. Zool. Soc. p. 498 (1908) (*Gorytes l.*).

These species, however, differ from typical *Clytemnestra* and approach *Miscothyris*, Sm., in having the first recurrent

nervure received before the apex of the first cubital cell. *C. sanguinolentus* also has the posterior tibiæ serrate near the apex, but not so strongly as in *Miscothyris*.

Subfamily *SERICOPHORINÆ*.

*Zoyphium doddi*, sp. n.

♂. Minutus, niger; clypeo, mandibulis, scapo pedibusque flavis; flagello tegulisque testaceis; alis hyalinis, venis testaceis, stigmate fusco.

Long. 4 mm.

Mandibles strongly notched beneath; clypeus very broadly rounded at the apex, short. Inner margins of the eyes parallel. Antennæ inserted low down on the sides of the clypeus, nearly as far from each other as from the eyes, short, thickened towards the apex, the apical joint pointed. Front broad, covered with delicate golden pubescence; posterior ocelli far apart, more than twice as far from each other as from the eyes. Head and thorax opaque; a deeply punctured transverse groove at the base of the scutellum; median segment truncate posteriorly, the dorsal surface with indistinct oblique striæ at the base; depressed on the median line, with a rather strong carina in the depression; the surface of the truncation with several more distinct oblique striæ. Abdomen shining, closely and minutely punctured, the hypopygium produced into a spine at the apex. First recurrent nervure received by the first cubital cell a little beyond three-quarters from the base, second received by the second cubital cell at two-thirds from the base. Third cubital cell about half as long on the radial nervure as the first; the second pointed on the radial nervure, longer than the third on the cubital nervure.

*Hab.* Cairns, Queensland (*F. P. Dodd*). Ex coll. Perkins.  
♀. Unknown.

In colour this species recalls *Z. frontale*, Turn., described from a female, but in that species there are only two cubital cells. So far as I can see, the antennæ in the male are only twelve-jointed. This is the case in *Z. rufonigrum*, Turn., though the figure (*P. Z. S.* 1908, p. 495) shows only eleven joints, an obscure division in the club being omitted. *Z. erythrosoma*, Turn., and *Sericophorus viridis*, Sm., show a similar structure, but in the latter species the club is truncate at the extremity and very thick, not pointed. The reduction in the number of joints seems to be due to the fusion of two joints in the club. In *S. viridis* the

fourth, fifth, sixth, and seventh joints of the flagellum are flattened beneath and more or less produced into spines as in some species of *Bembex*; but the antennæ of the male of *S. relucens*, Sm., resemble those of *Zoyphium*. The males of *Sphodrotes*, Kohl, show no such antennal peculiarities and, as I have previously pointed out, that genus is near *Acanthostethus*, Sm., and cannot be placed very near *Sericophorus* and *Zoyphium*. The males of *Sericophorus* appear to be much rarer in collections than the females; and only one species of the genus, *S. relucens*, Sm., has a wide range, occurring from Cape York to Adelaide, and at least as far west as Hermannsburg in Central Australia.

*Zoyphium dipteroides*, Turn.

*Sericophorus dipteroides*, Turn. Ann. & Mag. Nat. Hist. (7) xix. p. 275 (1907). ♀.

*Zoyphium funebris*, Turn.

*Sericophorus funebris*, Turn. Ann. & Mag. Nat. Hist. (7) xix. p. 276 (1907). ♀.

These two species have no appendiculate cell, and therefore cannot be retained in *Sericophorus*. How far this distinction will prove to be of generic value is doubtful, as it places the very closely allied *S. bicolor*, Sm., and *Z. erythrosoma*, Turn., in different genera. None of the species of *Zoyphium* described by me have the tooth on each side of the second (first) dorsal segment mentioned by Kohl in his description of the genus.

Subfamily CRABRONINÆ.

*Dasyproctus expectatus*, sp. n.

♀. Nigra, opaca; mandibulis basi scapoque flavis; pronoto in medio interrupto, callis humeralibus, segmento abdominali secundo macula minuta utrinque, tertio quartoque fascia angusta basali utrinque, quintoque macula mediana nigra, aurantiacis; tibiis tarsisque testaceo-brunneis; alis hyalinis, venis nigris. Long. 10 mm.

Clypeus covered with short silvery pile, the anterior margin produced in the middle into two short blunt teeth. Eyes separated from each other at the nearest point on the front by a distance equal to about two-thirds of the length of the scape; ocelli in a very broad triangle, the posterior pair a little nearer to each other than to the eyes, and about half as far again from the posterior margin of the head as



from each other. Head large and broad, thinly covered with short pale fulvous pubescence, the cheeks broad and covered with silvery pubescence above the base of the mandibles. Pronotum depressed in the middle; the cordate space at the base of the median segment coarsely obliquely striated at the base, coarsely reticulate at the apex, with a deep median sulcus. Abdomen opaque; the basal segment a little longer than the posterior femur, the basal two-fifths forming a narrow petiole, the apical portion gradually widened; the fifth segment clothed with short, pale, fulvous pubescence. Transverse cubital nervure received close to the middle of the radial cell; recurrent nervure received beyond two-thirds from the base of the cubital cell. Sides of the median segment with very fine vertical striæ.

*Hab.* Sydney (*R. C. L. Perkins*); June 1904.

*Dasyproctus muiri*, sp. n.

♀. Nigra; mandibulis basi, scapo, tibiis apice, tarsisque basi flavis; pronoto, tegulis macula basali, scutello macula obliqua utrinque, mesopleuris maculis duabus parvis, segmentisque dorsalibus 2-4 macula transversa basali flavo-ochraceis; alis hyalinis, cellula radiali margine costali infuscata.

Long. 9 mm.

Opaque; clypeus, front, and cheeks clothed with silver pubescence. Clypeus with a low median carina, produced into two small blunt teeth on the middle of the apical margin. Front rather deeply hollowed, with an arched carina above, the eyes at the nearest point separated by a distance equal to about one-third of the length of the scape. Head large, the posterior ocelli a little further from the eyes than from each other, and half as far again from the posterior margin of the head as from each other. A short depression along the inner margin of the eyes before the summit. Second joint of the flagellum about twice as long as the first and almost half as long again as the third. Enclosed area at the base of the median segment finely obliquely striated, punctured between the striæ, and divided by a median sulcus which is continued to the apex of the segment, the sides finely obliquely striated. First abdominal segment about one-quarter longer than the posterior femur, the narrow petiole almost as long as the gradually broadened apical portion. Transverse cubital nervure received close to the middle of the radial cell; recurrent nervure received beyond two-thirds from the base of the cubital cell.

*Hab.* Amboina (*F. Muir*). Ex coll. Perkins.

Very near *D. expectatus*, but the eyes are nearer together on the front and the first abdominal segment distinctly longer. There are also small colour differences, especially on the legs.

*Dasyproctus burnettianus*, sp. n.

♀. Nigra, mandibulis, scapo, flagello articulis duobus basalibus, pronoto, callis humeralibus, mesopleuris macula parva, scutello, petiolo macula parva utrinque, segmentis dorsalibus 2-4 fascia interrupta basali, femoribus subtus, tibiis tarsisque flavo-ochraceis; segmentis dorsalibus quinto sextoque totis quartoque apice testaceis; alis sordide hyalinis.

Long. 9 mm.

Eyes separated on the front by a distance equal to fully half the length of the scape; second joint of the flagellum a little longer than the third and less than twice as long as the first; the front deeply hollowed, the antennæ inserted nearer to the eyes than to each other; a narrow groove on the inner margin of the eyes near the summit. Head very large; ocelli placed in a very broad triangle, the posterior pair nearly as far from the eyes as from each other, and more than half as far again from the posterior margin of the head as from each other. A deeply punctured transverse groove at the base of the postsutellum and another at the base of the median segment; the enclosed triangular area at the base of the median segment finely obliquely striated and divided by a sulcus which is continued to the apex of the segment. First abdominal segment nearly half as long again as the posterior femur, the narrow petiole occupying a little more than half the length of the segment; apical segment very narrow, the sides almost parallel. Transverse cubital nervure received a little before the middle of the radial cell, recurrent nervure received a little beyond two-thirds from the base of the cubital cell.

*Hab.* Bundaberg, Queensland (*R. C. L. Perkins*).

Differs from *D. expectatus* in the longer petiole as well as in colour and in the proportion of the joints of the flagellum. I do not think that this is the female of *D. conator*, Turn., though it is just possible.

*Dasyproctus agilis*, Sm.

*Crabro (Rhopalum) agilis*, Sm. Proc. Linn. Soc., Zool. iii. p. 18 (1858). ♀; Turn. Proc. Zool. Soc. p. 528 (1908).

*Dasyproctus conator*, Turn.

*Crabro* (*Rhopalum*) *conator*, Turn. Proc. Zool. Soc. p. 526 (1908). ♂.

*Dasyproctus idoneus*, Turn.

*Crabro* (*Rhopalum*) *idoneus*, Turn. Proc. Zool. Soc. p. 527 (1908).  
♀ ♂.

*Crabro* (*Crossocerus*) *prosopoides*, Turn.

*Crabro prosopoides*, Turn. Proc. Zool. Soc. p. 528 (1908). ♂ ♀.

The following Australian species are closely allied to the European *Crabro vagus*, Linn., and may be placed in the subgenus *Solenius*, though differing in the sculpture and the absence of constrictions between the abdominal segments from *C. interruptus*, Lep., the type of the subgenus :—

1. *Crabro* (*Solenius*) *tridentatus*, Sm. Trans. Ent. Soc. London, p. 250 (1868). ♀.
2. *Crabro* (*Solenius*) *cinctus*, Turn. Proc. Zool. Soc. p. 531 (1908). ♀.
3. *Crabro* (*Solenius*) *bivittatus*, Turn. Proc. Zool. Soc. p. 534 (1908). ♀.
4. *Crabro* (*Solenius*) *conglobatus*, Turn. Proc. Zool. Soc. p. 533 (1908).  
♀ ♂.
5. *Crabro* (*Solenius*) *tasmanicus*, Sm. Cat. Hym. B.M. iv. p. 425 (1856). ♀.
6. *Crabro* (*Solenius*) *mackayensis*, Turn. Proc. Zool. Soc. p. 532 (1908). ♀.
7. *Crabro* (*Solenius*) *ordinarius*, Turn. Proc. Zool. Soc. p. 532 (1908).  
♀ ♂.
8. *Crabro* (*Solenius*) *neglectus*, Sm. Trans. Ent. Soc. London, p. 249 (1868).

In *ordinarius*, *conglobatus*, and *bivittatus* the mandibles are tridentate at the apex, as is usual in *Solenius*, not bidentate as stated erroneously in the original description.

VII.—*Descriptions of new Harvest-men of the Family Phalangodidæ.* By STANLEY HIRST.

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[Plate I.]

*Key to the Genera of Phalangodidæ which are represented in the British Museum Collection.*

- a. Eyes placed on a single tubercle.  
a<sup>1</sup>. A long median thorn present on the  
ocular tubercle.

- a*<sup>2</sup>. Transverse grooves of scutum well defined and four in number.  
Thorn of ocular tubercle not furnished with granules or processes.
- a*<sup>3</sup>. Patella of palp quite unarmed.
- a*<sup>4</sup>. Palp of moderate length ..... *Pseudobiantes*, Hirst.
- b*<sup>4</sup>. Palp very long, especially its femur and patella ..... *Parabiantes*, gen. nov.
- b*<sup>3</sup>. Patella of palp armed with long spines.
- a*<sup>5</sup>. Femur of palp armed below with several long spines. Femora of first and second legs quite unarmed ..... *Epedanus*, Thorell.
- b*<sup>5</sup>. Femur of palp armed both above and below with processes of moderate length. Femora of first and second legs armed with short processes ..... *Plistobunus*, Poc.
- b*<sup>2</sup>. Transverse grooves five when distinct.  
Central thorn of ocular tubercle nearly always furnished either with granules or processes.
- a*<sup>6</sup>. Femur of palp strongly compressed laterally ..... *Baramia*, gen. nov.
- b*<sup>6</sup>. Femur of palp at most only slightly compressed laterally ..... *Sitalces*, Simon, and  
[*Podoctis*, Thorell.]
- b*<sup>1</sup>. Ocular tubercle without a long central thorn.
- a*<sup>7</sup>. Abdominal part of scutum provided with a low but conspicuous tumulus in the middle ..... *Vima*, gen. nov.
- b*<sup>7</sup>. Abdominal part of scutum without tumulus.
- a*<sup>8</sup>. Fourth leg of both sexes quite unarmed ..... *Phalangodes*, Tellkampff.
- b*<sup>8</sup>. Fourth leg of male furnished ventrally with stronger spinules than is the case in the female and with a conspicuous process (or processes?) on each side near the distal end of the tibiæ (see Pl. I. fig. 1 *a*) ..... *Zalmoxis*, Sör.
- b*. Eyes not placed on a single tubercle, but widely separated from one another and either sessile or each placed on a very slight tumulus.
- a*<sup>9</sup>. Femur of palp armed below with a single spine or without any ventral spines. Femur of first leg unarmed.  
No thorn between the eyes ..... *Hinzuanus*, Karsch, and  
[*Lacurbs*, Sör.]
- b*<sup>9</sup>. Femur of palp armed below either with long spines or long processes. Femur of first leg usually armed with long spines. A thorn often present midway between the eyes.



- a*<sup>10</sup>. Femora of posterior legs straight  
and unarmed ..... *Ibalonius*, Karsch.  
*b*<sup>10</sup>. Femora of posterior legs curved and  
armed ventrally with processes .. *Holozoster*, Loman.

*Zalmoxis austerus*, sp. n. (Pl. I. figs. 1, 1 a.)

♂. *Body*.—The shape of the body of this new species is very like that of *Z. robusta*, Sör., as figured by Sörensen, the cephalothoracic part of it being much narrower than and not nearly so high as the abdominal part.

*Scutum* longer than the patella + the tibia of the fourth leg. It has five transverse grooves; the first one, which is well defined and procurved, forms the boundary between the cephalothoracic and abdominal parts of the scutum; the other grooves are not so distinct, the one between the first and second areas of the abdominal part being faint. First abdominal area large, but its length (when measured along the median line) is very much less than that of the cephalothoracic part. Except for three or four rather inconspicuous granules on each side of the anterior margin and for one or two lateral granules, the surface of the cephalothoracic part is quite smooth. Numerous granules are present on the first abdominal area and a rather narrow transverse band of them is present on each of the three following areas; the granules of which these bands are composed are not very regularly arranged, but they are usually about two deep. The last abdominal area has fewer granules on its surface than the other areas, and for the greater part of its width they are arranged in a single series only; like those of the penultimate area, they are sharply pointed and directed backwards. There is also a longitudinal series of granules on each side of the scutum. *Ocular* tubercle situated near the anterior margin. It is elongated transversely, being considerably wider than long, and has no large processes of any kind on its surface, but is furnished with a number of granules, which are not arranged in a regular manner.

*Free dorsal segments*.—The two anterior of the free dorsal segments each have a single transverse series of granules, similar to that on the last area (posterior margin) of the scutum; on the third free segment the granules are more numerous and less regular in arrangement and are mostly ranged about two deep. The fourth free dorsal segment has numerous granules and they are not arranged in series.

*Ventral surface*.—Fourth coxa very much wider than the others. There are a number of distinct granules on the ventral surface of the first coxa, but only obsolete granules

are to be seen on the other coxæ. A transverse series of minute granules is present on each of the sternites. On each side of the first sternite there is a slight ridge which commences at the spiracle and runs forward for some distance.

*Chelicera.*—Proximal segment short and quite smooth. Second segment moderately stout; dorsally it has only two or three obsolete granules, which carry hairs.

*Palp* not very long. There are two or three very little granules on the dorsal surface of the trochanter, and a conical granule and two processes, one of which is long, are situated on its lower surface. Femur armed with a single long spine on its inner side near the distal end; ventrally it has three spines (and also a little tooth-like process), the two spines near its proximal end being much the longest. Patella with a long spine on the inner side. Tibia much higher and wider than the other segments of the palp; it has three spines on each side, the distal one of the outer side being short. Tarsus with two long spines on each side and also with a very short distal spine on each side.

Legs short; the fourth is the longest and stoutest (when they are arranged according to length, their order is as follows: 4, 2, 3, 1). The denticles on the ventral surface of the femur of the fourth leg, especially those near the distal end, are larger than those of the rest of its surface. Tibia of fourth leg stoutest nearest the distal end; besides the denticles on its surface, it has a sharply pointed ventral process on each side near the distal end, the outer one being long. Number of tarsal segments 3, 7, 5, 6. Claws of posterior legs smooth.

*Colour* blackish brown. Appendages dark brown, but the coxæ of the legs are pale above and the tarsi of all the legs, except those of the second pair, are rather pale also.

*Measurements in mm.*—Length of body 4.1, of scutum 3.25.

*Material.*—Two specimens from New Britain (Neu Pomern); one of which is an adult male and has the penis extruded. These specimens were collected by Prof. Willey in the year 1897.

*Remarks.*—This new species resembles *Z. pygmaea*, Sör., in having its ocular tubercle placed much nearer to the anterior margin than to the first transverse groove. The shape and granulation of the body are, apparently, quite different to what they are in *Z. pygmaea*, however.

#### Genus VIMA, nov.

Cephalothoracic part of scutum only slightly convex. Ocular tubercle low and transverse and much wider than

long ; on each side of its upper surface a minute and rather inconspicuous granule is present. Abdominal part of scutum furnished with a low whitish rounded eminence in the middle of its surface. Palp armed with spines of the usual Phalangodid type. [For their number and arrangement, see the specific description.] Fourth coxa not so very much broader than the third, instead of being very much broader than it, as in the Gonyleptidæ.

*Vima insignis*, sp. n. (Pl. I. fig. 2.)

*Dorsal surface. Scutum.*—Both cephalothoracic and abdominal parts slightly convex ; transverse grooves ill defined, except the one which forms the boundary between the two principal parts of the scutum and that which is placed just in front of its posterior margin. [For the structure of the ocular tubercle, see the generic description.] A low rounded eminence, which is sometimes circular, sometimes oval in shape, is situated in the middle of the abdominal part of the scutum. Otherwise the scutum is almost smooth, for it has only a few very minute and inconspicuous granules on its surface, those of the transverse row, which occurs near the posterior margin, being perhaps the most distinct. *Free dorsal segments* each with a transverse row of minute and inconspicuous granules.

*Ventral surface.*—First coxa with a process in front, and with a transverse series of rather large granules on its anterior margin below, the outer ones being the largest. A transverse series of obsolete granules is usually present on the surface of each of the remaining coxæ and a few granules are also present on the sternites.

*Chelicera.*—On the inner side of the dorsal surface of the proximal segment two minute granules are present, and two or three little granules, which are slightly more distinct, also occur on the outer side. Second segment furnished with several granules on the inner side of its upper surface, but with one or two exceptions they are quite obsolete.

*Palp* armed with long spines. Trochanter with only two minute granules below. Femur armed with an apical spine on its inner side, and with a ventral row of four spines, the two proximal ones being much larger than the other two. Patella with a single spine on its inner side. Tibia with two spines on its inner side, and sometimes it has also an additional little denticle distally ; on its outer side there are three spines and also a minute proximal denticle. Tarsus with two spines on each side and a short apical spine on the

inner side also; the apical spine on the outer side is either quite obsolete or absent.

*Legs* long. Their femora are furnished with very minute granules; femur of first leg without any processes. Patellæ of posterior legs with two or three minute granules at the distal end above. Apparently there is no scopula on the tarsi of the posterior legs and their claws are without teeth. Tarsal segments 7, ?, 7, 7.

*Colour*.—Body and appendages brown; the eminence in the centre of the abdominal part of the scutum is white; segments of scutum also seemingly faintly outlined in white. Patellæ and the distal ends of the femora and of the tibiæ of the legs blackish.

*Measurements in mm.*—Length of trunk 2·5, of first leg 16·25, of second (?), of third 21, of fourth 31.

*Material*.—Four specimens collected by Rose Lloyd in the Higher Potaro River District, British Guiana.

*Ibalonius quadriguttatus*, sp. n. (Pl. I. figs. 3, 3 a.)

*Scutum* convex, and it is a little shorter than the tibia of the third leg. There are three pairs of thorns on its surface. Those of the first pair are long and they are situated at about a third of the length of the scutum from its anterior margin. They are followed at a short distance by the thorns of the second pair, which are quite short. The thorns of the third pair are long; they are placed at some distance in front of the posterior margin and are separated from it by a transverse groove. Some distance in front of this last pair of thorns there is a pair of little granules and then a transverse series of about four granules. A similar series is also present on the last area of the scutum. [I think that the first pair of thorns is placed on a part of the surface of the scutum corresponding to the hinder half of the cephalothoracic part, and that the second pair belongs to the first abdominal area; the last pair of thorns belongs, without doubt, to the fourth abdominal area of the scutum. Owing to the absence of all of the transverse grooves, except the last one, it is difficult to be certain about this, however.] The distance which separates the eyes from one another is about twice that which separates them from the lateral margin. Each eye is placed on a very slight elevation and a little arch-like structure, carrying a little pointed granule on its dorsal surface, joins each of these two elevations to the anterior margin of the scutum.



A transverse series of little granules is present on each of the anterior *free dorsal segments*, but they are only distinct on the first one, the granules on the others being obsolete.

*Ventral surface*.—There are a number of granules and some rather long conical processes on the ventral surface of the first coxa. The second coxa has a transverse row of little granules and also some scattered obsolete granules. A number of obsolete granules also occur on the posterior coxae, but the sternites have not any granules.

*Chelicera*.—Proximal segment quite short (for its shape, see fig. 3). It has a single long pointed process on the inner side below and two long processes on the outer side. There are also one or two conical granules on the dorsal surface. Second segment fairly large and swollen; on its upper surface there are about seven tooth-like processes, and a large tooth-like process and a granule are present below.

*Palp*.—On the upper surface of the coxa of the palp there is a large curved process. The trochanter has a little pointed granule above; and it has a long spine and a little tooth-like process below, the former equalling the longest spine of the ventral surface of the femur in length. Two or three little granules occur on the upper surface of the femur and a rather long curved process is also present at its proximal end; below, this segment has 4–5 spines and processes, three of them being long and one or two quite short; a little spine is also present on the inner side near the distal end. Patella armed with two inner and one outer spine; there is also a little granule on its dorsal surface. Tibia and tarsus shaped much as in *Epedanus*, but not very wide. Tibia with three inner and two very long outer spines. Tarsus with two spines on each side.

*Legs long*. A couple of conical processes and a granule are present on the ventral surface of the trochanter of the first leg. Femur of first leg unarmed, but it is furnished with numerous minute granules. A very long process is placed on the anterior surface of the trochanter of the second leg, and there are a few little granules at the proximal of the femur of this leg. Coxa of fourth leg with a rather long conical tubercle or process on its upper surface. Scopula very dense on the last two segments of the posterior tarsi; claws of posterior legs smooth. Number of tarsal segments 4, 10, 5, 5; the proximal segment of the tarsus of the second leg is long.

*Colour* (faded?) pale yellow-brown; there are two iridescent golden spots on each side of the upper surface of the

trunk, one spot being placed immediately in front of the other; the thorns of the scutum are not darker than its surface.

*Measurements in mm.*—Length of trunk 3.75, of scutum 3.25, of fourth leg 25.

*Material.*—A single male specimen from Batjan (Dr. W. Kükenthal).

*Ibalonius kuekenthali*, sp. n.

Very closely allied to *I. quadriguttatus*, sp. n., but differing in the following details of structure and coloration:—

*Scutum* armed with two pairs of long thorns, which correspond to the first and third pairs of *I. quadriguttatus*, but the second pair of very short thorns, which are present in that species, are absent in *I. kuekenthali*. A little granule is placed midway between the eyes. A pair of little granules is present on the part of the scutum which apparently corresponds to the first abdominal area and there are three transverse series, each of four little granules, on the parts of the scutum apparently corresponding to the second, third, and fifth (last) abdominal areas of the scutum. As in *I. quadriguttatus* only the last transverse groove is distinct.

*Ventral surface.*—The granules on coxæ 2–4 are more numerous and more distinct in this species than is the case in *I. quadriguttatus*.

*Chelicera* and *palp* precisely similar in structure to those of *I. quadriguttatus*. The femur of the first leg is more coarsely granular than in that species. Number of tarsal segments 4, 12, 5, 5.

*Colour.*—Body pale brown, but its spines are very dark brown. There are no golden spots on the dorsal surface. Chelicera slightly infuscated; the palp pale; legs rather dark brownish.

*Measurements in mm.*—Length of trunk 3.75, of scutum 3.5, of fourth leg 26.

*Material.*—A single male example from Batjan, collected by Dr. W. Kükenthal.

*Remarks.*—The body and legs of this species are darker in tint (brownier) than is the case in *I. quadriguttatus*, and there are no golden spots on the scutum; moreover, the four thorns are much darker than the surface of the scutum. Besides this difference in coloration there are the slight structural differences noted above.

The most striking feature of these two new species of *Ibalonius* is the absence of the thorn which is usually present

between the eyes in this genus, but Dr. J. C. C. Loman\* has already commented upon two female specimens of *Ibalonius* which did not possess this thorn.

*Podoctis taprobanicus*, sp. n. (Pl. I. fig. 4.)

*Dorsal surface* strongly convex. *Scutum* about as long as the metatarsus of the third leg, slightly longer than the patella + the tibia of the third leg, and a little shorter than the patella + the tibia of the fourth. Transverse grooves five in number, the first two meeting one another in the mesial line. A pair of long and sharply pointed thorns, which are stout at the base, are situated near the middle of the fourth abdominal area. On each side of the anterior margin of the scutum a ridge supporting a row of six conical granules is present, and this ridge is joined to the ocular tubercle by a distinct arch, formed by two fused granules. A tooth-like projection is placed on each side of the scutum, close to the lateral margin and some distance behind the anterior margin. Numerous very fine granules, each carrying a short hair, also occur on the surface. Towards the middle of the hinder part of the cephalothoracic area there is a pair of slight elevations on which granules similar to those on the rest of the surface are present, one or two of them being slightly enlarged, however; one or two slightly enlarged granules are also present laterally in this part of the scutum. Besides the minute granules, each of the abdominal areas of the scutum, except the fourth, has a few larger granules, which are arranged in a single transverse row. *Ocular tubercle* placed slightly nearer the anterior margin of the cephalothoracic area than to the posterior margin. It is very wide at the base; in the middle there is the usual thorn; it has a very stout and wide base, which is rounded posteriorly, but almost vertical in front; the thorn which springs from this tubercular base is straight and fairly long, and as is usual in the genus *Podoctis*, it is directed forwardly. Each of the two eyes is situated on the side of a small lateral tumulus on the ocular tubercle. Except anteriorly, where it is quite smooth, its surface is furnished with numerous minute granules. Several slightly larger granules can be distinguished, one of them being placed in the middle of the upper surface of the basal portion of the spine and one or two others on each side of it; on each side of the spine itself a slightly enlarged granule is also present. *Free dorsal segments* 1-3 each furnished with a transverse row of enlarged

\* 'Nova Guinea,' vol. v. p. 4 (1906).

granules, those in the middle of the row being slightly larger than the others and conical in shape. Fourth dorsal segment without any especially large granules.

*Ventral surface*.—Coxæ with a number of distinct granules, and each sternite has a single transverse row of granules.

*Chelicera*.—First segment rather short; on its dorsal surface there is a little granule, and ventrally on the outer side this segment has 2–3 conical granules, which are situated at the proximal end. There are 6–7 long conical granules or tubercles on the upper surface of the second segment and they occupy its entire length, but are not very regular in arrangement; two or three of them are larger than the others.

*Palp* stout. Two conical granules, placed close together, are present on the dorsal surface of the coxa. Trochanter ventrally with two sharply pointed projections, the anterior one being comparatively long. Femur with an apical spine on its inner side; ventrally it has a small denticle at the proximal end and also three long spines, which are situated at equal distances from one another. Proximal end of patella narrowed; this segment has two long inner spines, and on the outer side it has a sharp little denticle and a moderately long spine. Tibia with three spines on each side, the middle one being the longest in both cases; on the outer side there is also a minute apical denticle. Tarsus about as long as the tibia, and furnished with two spines on each side, those of the proximal pair being the longest.

Legs 2, 4, 3, 1. With the exception of those of the first pair, which are very much shorter than the others, they are fairly long. Second leg a little longer than the fourth. A rather long upwardly directed process is placed on the dorsal surface of the fourth coxa and a much smaller, but very similar, process occurs on the coxa of the second leg. Trochanter of first leg with several granules below, two or three of them being fairly large and conical in shape. Only very minute and inconspicuous granules are present on the dorsal surface of the femur of the first leg, but it has a longitudinal series of spines below, four of which are long, and these long spines alternate with short ones, the latter being five in number, including the two very short ones at the distal end of the row. There are four granules on the lower surface of the trochanter of the second leg, three of them being fairly large and conical. Tarsal segments 4, 8 or 11, 5, 5; the tarsus of one of the legs of the second pair has eight segments, but that of the one on the other side has eleven, so



that possibly one of them is abnormal. Claws of posterior legs unarmed.

*Colour*.—Body rather dark brown above; on each side of the abdominal part of the scutum there is a pair of little yellow spots, one spot being placed in front of the other; the anterior one is situated on the hinder margin of the first abdominal area, and the other on the second abdominal area. Legs brownish; the femora, tibiae, and metatarsi of the posterior legs are furnished with minute dark spots; the extreme distal end of the metatarsi and the entire length of the tarsi of all the legs are pale.

*Measurements in mm.*—Length of trunk 5.25, of scutum 4, of second leg (from base of femur) 18, of fourth leg 16.25.

*Material*.—A single specimen from Punduloya, Ceylon; collected by Mr. E. E. Green.

*Remarks*.—This species resembles *P. pictulus*, Poc. (from Kandy?) in not having any spines on the upper surface of the femur of the first leg, but is larger in size and also differs in coloration, in the position and structure of its ocular tubercle, armature of scutum, &c.

*Podoctis willeyi*, sp. n. (Pl. I. figs. 5, 5 a.)

*Dorsal surface* strongly convex. *Scutum* longer than the tibia of the third leg, but not so long as the tibia of the fourth. Only four transverse grooves are visible on its surface in the adult, and the second and third of them are sometimes indistinct; the transverse groove which is normally present between the cephalothoracic and abdominal parts of the scutum is indistinct or absent; in young examples all five transverse grooves can be distinguished, the one between the cephalothoracic and abdominal parts being quite distinct. The first apparent area, therefore, consists of the cephalothoracic part + the first abdominal area of the scutum, and is very large, its length exceeding that of the rest of the scutum. Two pairs of long thorns are present on the scutum; the first pair is situated some distance in front of the first transverse groove, and these thorns are a little shorter and are situated a little further apart than those of the hinder pair; the latter are placed on the penultimate abdominal area. Near the anterior margin on each side there is a ridge, but the granules which are situated on it are quite small in size; it is joined to the ocular tubercle by an arch-like structure, exactly as in *P. taprobanicus*, sp. n., and a

minute granule is situated on the middle of this arch. Numerous minute granules, bearing short hairs, are present on the surface and on the bases of the large thorns. A transverse series of larger granules is present just in front of the first distinct transverse groove, and a similar row is present on each of the following areas of the scutum, with the exception of the penultimate one. *Ocular tubercle* situated at quite a short distance from the anterior margin; it is wider than that of *P. taprobanicus*, its width being about half the length of the scutum, and is low laterally; in the middle there is the usual long thorn, the base of which is very wide, but not nearly so stout as the base of the central thorn of the ocular tubercle of *P. taprobanicus*. Each of the *free dorsal segments* has a transverse row of granules similar to those which are present on the abdominal segments of the scutum.

*Ventral surface* furnished with numerous minute granules; a number of larger conical granules occur on the coxa of the first leg, and other granules which are not so large or distinct are present on the coxa of the second.

*Chelicera*.—Proximal segment of chelicera rather long, but not slender; its length is about equal to that of the second segment (not including the finger); on the inner side it has three rather long tooth-like processes and also one or two granules; on its outer side there is a series of six long processes (including the apical one, which is not so strong or so well defined as the others). Second segment considerably stouter than the first; a little process is present below on its inner side near the proximal end; dorsally this segment is furnished with a number of minute denticles and also with four larger tooth-like tubercles, of which the largest one is placed near the point of attachment of the movable finger and is sometimes divided into two points at its apex. Both the fingers have four teeth on their edge, three of which are placed near the apical end of each finger, and the remaining tooth, which is very large in the case of the movable finger, is placed midway between these three distal teeth and the proximal end of the finger.

*Note*.—This description is based on the chelicera of a specimen which I believe to be a fully adult male. The chelicerae of the other specimens are very different in appearance, the proximal segment being considerably shorter and armed with fewer lateral processes. I think that these differences are not due to sex in this particular instance, but merely to immaturity. The dentition of the fingers is the same in these specimens as in the adult one.

*Palp* slender, its coxa is armed above with a rather long curved process. Trochanter ventrally with a rather long process and a short tooth-like process. Femur armed below with three spines, which are practically equal in length; the spine which is usually present in this genus on the inner side of the femur near the apical end is absent in this species. Basal portion of spines of patella, tibia, and tarsus very much shorter than they are in *P. pictulus*, Poc., *P. taprobanicus*, sp. n., &c., and the terminal part is generally very long and slender. There are two spines on the inner side of the patella, the one near the proximal end being much shorter than the other; on the outer side there is a single long spine. Three spines occur on the inner side of the tibia, but the one which is placed nearest the proximal end is much shorter than the other two; this segment has two very long spines on its outer side, and their bases are comparatively long for this species, especially that of the proximal spine. Tarsus not quite so strongly flattened ventrally as is usually the case in the genus *Podoctis*; it has two fine spines or bristles and three shorter bristles on its inner side, and there are two long fine spines or bristles on its outer side. On the upper surface of the femur of the palp there are several granules, two processes or granules, which are situated close to the proximal end of the segment on its inner side, being more conspicuous than the others. One or two inconspicuous granules are sometimes also present on the upper surface of the patella and tibia.

*Legs* 2, 4, 3, 1. First leg very short, the others rather long. On the dorsal surface of the coxa of the fourth leg there is a large upwardly directed process, resembling that which is present in the same position in *P. taprobanicus*, sp. n., and the coxa of the second leg has a very similar process, but it is much smaller. Ventral surface of trochanter of first leg furnished with 3-4 fairly large conical processes, each of them bearing a fairly long seta. Femur of first leg with only two or three obsolete granules on its upper surface; below it has a longitudinal series of three conical processes, the first one of which is placed close to the proximal end of the segment; each of them bears a seta, and they are smaller than the processes of the ventral surface of the trochanter. Tarsal segments 6, 12-14, 5, 5. Claws of posterior legs apparently without any teeth.

*Colour*.—Trunk and appendages rather dark brown, but the trochanter of the first leg and the proximal end of its femur are quite pale; the tibia of the first leg has a pale ring, and the femora, tibiæ, and metatarsi of the other legs

are each marked near the distal end with a pale ring, but the ring of the femur of the second may be indistinct or absent; the extreme distal end of the metatarsi and the entire length of the tarsi of all the legs except the second pair are pale.

*Measurements in mm.*—Length of trunk of largest specimen 4.25, of scutum 3.5. (A smaller specimen has the scutum 2.75 mm. long and the fourth leg 15.5 mm. in length.)

*Material.*—Four examples collected by Prof. Arthur Willey in New Britain (now known as Neu-Pommern) in the year 1897. I think that one of these specimens is an adult male.

### Genus *BARAMIA*, nov.

The shape of the femur of the palp is the distinguishing feature of this new genus, which otherwise closely resembles *Podoctis*, Thor., in structure.

#### *Baramia vorax*, sp. n. (Pl. I. figs. 6, 6 a, 6 b.)

Dorsal surface convex. *Scutum* about as long as the tibia of the third leg, considerably shorter than the tibia of the fourth and slightly less than half the length of that of the second. Transverse grooves five in number. There are seven conspicuous thorns on the surface (not including the three which are present on the ocular tubercle). The first pair of thorns is situated in the middle of the second abdominal area, and they are of considerable length. Those of the second pair are a little longer than those of the first, and they are placed in the middle of the fourth abdominal area of the scutum. There are three thorns on the fifth abdominal area, a long one being present in the middle and a comparatively short one on each side of it. A number of granules, each of which is furnished with a tiny hair, are also present on the surface of the scutum. On each side, near the anterior margin, there is a series of about six granules, the two outer ones being the largest; this series is joined to the ocular tubercle by a little arch-like structure, on the summit of which there is a little granule. The remaining granules of the cephalothoracic part are not distributed in a very regular manner, but those on the abdominal part of the scutum, although not numerous, are arranged in transverse series; the series on the last abdominal area is composed of more numerous granules than the others, however. There is also a longitudinal series of granules on each side of the scutum. The *ocular tubercle* presents much resemblance to that of the species of *Podoctis*. It is situated quite close to the anterior



margin of the scutum, and is not very low, but is elongated transversely, its width being about equal to the length of the cephalothoracic part of the scutum. The central thorn is inclined forwards and it is very long, its length considerably exceeding that of the longest of the thorns of the abdominal part of the scutum. Immediately to the inner side of each eye there is a fairly long thorn, but these lateral thorns are very much shorter than the central one. A number of granules similar to those on the surface of the scutum are also present on the ocular tubercle; several of them are placed on the base of the central thorn, and two very slightly larger ones are situated on the posterior surface of the slender portion of the thorn.

*Free dorsal segments* 1-3 each with a transverse series of little granules; the fourth free dorsal segment is furnished with rather numerous granules.

*Ventral surface.*—Numerous granules are present on the coxæ of the legs, and there is a transverse series of little granules on each of the ventral segments.

*Chelicera.*—Proximal segment long and comparatively slender; there are a number of granules on its upper surface, most of them being quite minute, but two or three larger pointed granules occur on each side of the upper surface; ventrally this segment has three or four little granules on its inner side and a longitudinal series of 5-6 elongated granules (or processes) on its outer side. The second segment is considerably stouter than the slender proximal segment and has seven processes, nearly all of which are long and acute, on its dorsal surface; it has also two conical processes (or granules) on the inner side below.

*Palp.*—Trochanter provided below with a longitudinal series of four processes. Femur compressed laterally and highest at the proximal end, its height gradually diminishing towards the distal end, which is almost cylindrical; on its dorsal surface this segment has only a series of minute granules, each with a fine hair, but there is a well-developed spine near the distal end on the inner side; below the femur is armed with a longitudinal series of eight spines. Patella with two inner and an outer spine. Tibia and tarsus distinctly flattened below, much as in *Epedanus* &c. There are three spines on each side of the tibia, the two distal ones on the outer side being very long; two tooth-like granules are present on the upper surface of this segment. The tarsus has two spines on each side, the proximal one of the outer side being very long.

*Legs* 2, 4, 3, 1. First leg very much shorter than the

others and the second leg much the longest. A little granule is present on the dorsal surface of the trochanter of the first leg, and this segment has two rather long setiferous processes or spines (and also two or three granules) on its lower surface. Femur of first leg armed with spines both above and below. Tarsal segments 3, 4, 5, 2. Claws of posterior legs unarmed.

*Colour* (faded) rather pale, but the dorsal surface is marked with darker specks and little patches. Femora, tibiæ, and the proximal end of the metatarsi of the legs conspicuously variegated with pale and dark bands.

*Measurements in mm.*—Length of trunk 2.5, of scutum 2.25.

*Material.*—A single adult male from the Baram River, collected by Dr. W. Kükenthal.

*Epedanus orientalis*, sp. n. (Pl. I. figs. 7, 7 a.)

*Scutum* very slightly longer than the tibia of the second leg and as long as the patella + the tibia of the fourth. It has four transverse grooves, the first being strongly procurved. The cephalothoracic part is large, its length being a little greater than that of the abdominal part; it has the three usual tooth-like processes on the anterior margin. Several little granules occur on each side near the anterior margin. There is a pair of fairly long thorns on the second of the abdominal areas of the scutum, and a lateral tooth-like process is sometimes present on each side of the last division. The greater part of the surface of the scutum is smooth, but a longitudinal series of minute granules runs down each side of it and the last area has a transverse series of minute granules; in one specimen the central granule of this transverse series is slightly larger than the others. *Ocular tubercle* situated practically in the middle of the cephalothoracic part of the scutum; the thorn is shorter than the transverse width of the tubercle.

Each of the first three of the *free dorsal segments* has a transverse series of granules, and sometimes the central granule is larger than the others. The last free dorsal segment is devoid of granulation.

*Ventral surface.*—A number of granules are present on the surface of the coxa of the first leg, most of them being very large and conical and arranged in a single transverse row. The second coxa has a transverse series of obsolete granules. There are not any distinct granules on the remaining coxæ nor on the sternites.

*Chelicera.*—Proximal segment long and almost cylindrical

for the greater part of its length, but its apical end is dilated. A number of conical granules and processes are present on its dorsal surface, and there are also two or three conical granules on the inner side below ; one of the processes on the outer side of the dorsal surface and one of the two which are present on the dorsal surface of the enlarged distal part of the segment are considerably longer than the others. Second segment greatly swollen and furnished with several tooth-like processes and granules on its dorsal surface, two or three of them being bifid apically ; this segment has also a single tooth-like process below.

*Palp* with the segments normal in shape and armed with long spines. Trochanter with a tooth-like granule and a long pointed process on its dorsal surface ; ventrally this segment has a long pointed process and sometimes also a little granule. Femur with two or three longitudinal series of granules above ; on its lower surface it has a row of six spines, the distal one being placed at some distance from the others ; there are also two spines on the inner side of the femur at its distal end. Patella armed with two inner and one outer spine. Tibia with three inner and four outer spines. Tarsus with three spines on each side.

*Legs*.—Trochanters of anterior legs furnished with one or two granules below. Femur of first leg unarmed ; femur of fourth leg almost straight. The number of tarsal segments is as follows :—8-9, 19, 7, 8. The claws of the posterior legs are unarmed.

*Colour*.—Dorsal surface dark brownish and usually marked with blackish reticulate markings. With the exception of the first one the sternites also are rather dark brownish ; but the first sternite and the coxæ are much paler in colour. Proximal segment of chelicera rather extensively darkened and the second segment has dark reticulate markings on the sides. Proximal segments of palp extensively infuscated, but the distal segments are either quite pale or only slightly darkened here and there. Legs brownish, but they become paler distally, and the distal ends of their metatarsi and the entire length of the tarsi are whitish.

*Measurements in mm.*—Length of trunk 3·75, of scutum 3, of fourth leg (from base of femur) 13·75.

*Material*.—Three male specimens, collected by Capt. S. S. Flower at Chantaboon, Siam.

*Epedanus siamensis*, sp. n. (Pl. I. fig. 8.)

*Scutum* a little shorter than the tibia of the second leg and considerably shorter than the patella + the tibia of the

fourth. The transverse grooves are four in number. On each side of the cephalothoracic part there is a semitransparent swelling similar to that which is present in the same position in the species of *Pseudobiantes*. A pair of thorns are placed on the abdominal part, and they are of practically the same size and are situated in the same position as those of *E. orientalis*, sp. n. The lateral tooth-like processes which are sometimes present on the last abdominal area of the scutum of *E. orientalis* apparently do not occur in the species now under discussion. There is a longitudinal series of very minute granules on each side of the scutum, and a transverse series of very minute granules is present on its last abdominal area. With the exception of those just mentioned there are very few granules on the surface of the scutum; but a few additional isolated ones are present on the abdominal part.

*Ocular tubercle* situated some distance in front of the middle of the cephalothoracic part. Its thorn is shorter than the transverse width of the tubercle.

The first two of the *free dorsal segments* each have a transverse series of very minute granules, and a quite obsolete transverse series may also be present on the third, but there are no granules on the fourth.

*Ventral surface*.—The first coxa has a transverse row of granules, but there are no distinct granules on the other coxæ nor are there any on the sternites.

*Chelicera*.—♂. Proximal segment very much shorter than and quite differently shaped to that of *E. orientalis*; it has only minute granules on its dorsal surface. Second segment swollen; its upper surface is furnished with several granules and also with a process bearing three or four little points or granules at the end. This process is placed close to the base of the immovable finger.

♀. Second segment of chelicera of female specimen not swollen, and the process which is situated on its upper surface near the base of the immovable finger is poorly developed; the shape and armature of the fingers are also different to what they are in the male.

*Palp*.—Trochanter of palp furnished with two or three conical granules above, and with another slightly larger one below. There is a longitudinal series of conical granules on the upper surface of the femur, and a series of four or five similar granules is also present towards the inner side of the ventral surface. The femur has also two spines on its inner side at the distal end and a row of five spines on the outer side of its ventral surface, the two of them which are placed



nearest the proximal end of the segment being the longest, whilst the distal one is the shortest. Patella, tibia, and tarsus armed with the same number of spines as in *E. orientalis*.

*Legs*.—Femur of first leg unarmed; femur of fourth almost straight. Number of tarsal segments 8-9, 22-24, 9, 10. Claws of the posterior legs each armed with a single large tooth.

*Colour*.—Body and appendages pale yellowish brown, but the distal ends of the metatarsi and the whole length of the tarsi are whitish.

*Measurements in mm.*—Length of trunk 3.75, of scutum 3, of fourth leg (from base of femur) 16.5.

*Material*.—A specimen of each sex from Chantaboon, Siam (*Capt. S. S. Flower*). The male has its very long penis fully extruded and the tip of the ovipositor of the female is visible when the genital operculum is lifted up.

*Remarks*.—Like *E. orientalis*, sp. n., this species has a pair of thorns on the second abdominal area of the scutum, but it can easily be distinguished from that species by the presence of the swollen area on each side of the cephalothoracic part of the scutum, by the shortness and difference in shape of the proximal segment of the chelicera, by the greater number of tarsal segments, &c. It is also much paler (yellow) than *E. orientalis*.

*Note*.—Dr. C. Fr. Roewer gives the shortness of the median spine as compared with the transverse width of the ocular tubercle as one of the characters distinguishing his two new genera (*Epedanellus* and *Takaoia*) from *Epedanus*. This character does not seem to be of much importance. In *Pseudobiantes japonicus*, Hirst, a species which has an ocular tubercle of the same type as the species of *Epedanus*, this thorn may be either distinctly longer or slightly shorter than the transverse width of the tubercle. In *Epedanus orientalis*, sp. n., it is shorter than the width of the tubercle, and yet this species is in all other respects quite a normal member of the genus *Epedanus*.

The shape of the proximal segment of the chelicera is another character employed by Dr. Roewer to distinguish the two new genera mentioned above, but the shape of this segment is very different in closely allied species of *Epedanus* (for instance, in the two new species described above), and this is also the case in the genus *Phalangodes*. I do not think myself that this character is of generic value.

## Genus PARABIANTES, nov.

Scutum with four well-defined transverse grooves. Ocular tubercle elongated transversely, but not very wide; the thorn which is situated in the middle of it is exceedingly long, its length being about twice the transverse width of the tubercle. Palp very long, the femur and the slender part of the patella being especially long; only the tibia and tarsus of this appendage are armed with spines. Femur of first leg unarmed.

The ocular tubercle of this genus is built on the same plan as that of *Epedanus*, *Pseudobiantes*, &c., but the palp closely resembles that of the species which were formerly referred to the *Hinzuanidæ*.

*Parabiantes longipalpis*, sp. n. (Pl. I. figs. 9, 9 a.)

*Scutum* as long as the patella + the tibia of the first leg and shorter than the tibia of the fourth. It has four well-defined transverse grooves, the one which separates the cephalothoracic part from the abdominal part being the deepest. Cephalothoracic part convex and fairly large, its length being equal to the united lengths of the first three abdominal areas of the scutum. First abdominal area longer than any of the other abdominal areas, but its length is less than that of the second and third taken together. There are a few granules on either side of the anterior margin, and a longitudinal series of granules is present on each side of the scutum; otherwise its surface is quite smooth. It has no processes or spines except the one which is present in the middle of the ocular tubercle. *Ocular tubercle* situated slightly in advance of the middle of the cephalothoracic part of the scutum [for the details of its structure, see the generic description].

*Free dorsal segments* quite smooth, granules being entirely absent.

*Ventral surface*.—Each of the coxæ of the legs has a single series of granules, but that on the fourth is obsolete [absent on one side]. Sternites quite smooth.

*Chelicera*.—Proximal segment elongated; it is subcylindrical for part of its length, but becomes gradually stouter towards the distal end; there are two or three granules on its dorsal surface near the proximal end and one or two obsolete granules near the distal end. Second segment fairly stout and with several granules on its dorsal surface.

*Palp* very long and only its tibia and tarsus are armed with spines. Its femur is extremely long, its length equalling

that of the body, and is slender and cylindrical, but the distal end is a little stouter than the rest of the segment; except for a little conical granule, which is situated on the ventral surface near the proximal end, the femur is quite unarmed. Patella very long; it is unarmed and is slender and cylindrical almost throughout its length, only the extreme distal end being enlarged. Tibia and tarsus fairly stout; they are bent in such a manner that the spines of the one segment work against those of the other, as in *Hinzuanus* &c. Tibia provided with three inner spines, all of which are long, the one which is placed nearest to the distal end being the shortest; on its outer side it has six spines, some of which are long and others short. Tarsus with three inner spines and four or five outer spines; this segment has also a number of sharply pointed denticles in the middle of its lower surface.

*Legs* 2, 4, 3, 1; the trochanters of the anterior legs each have a little granule on their upper surface and three granules on their lower surface; all the other segments of the legs are quite smooth and without either granules or spines. Tarsal segments 11-12, 30-32, 11, 11-13. Claws of the posterior legs unarmed.

*Colour*.—Body and appendages dark brown, but the tibia and tarsus of the palp are pale brown and the distal ends of the metatarsi and the entire length of the tarsi of the legs are quite pale.

*Measurements in mm.*—Length of trunk 7, of scutum 5.5, of first leg (from base of femur) 20.25, of second 37, of third 26.5, of fourth 34.5, of femur of palp 7, of patella of palp 4.75.

*Material*.—A single adult example of the female sex, collected by Dr. W. Kükenthal. No exact locality is given for this specimen, but it is probably either from Borneo or Halmaheira.

### *Hinzuanus parvulus*, Hirst.

*Hinzuanus parvulus*, Hirst, Trans. Linn. Soc. xiv. p. 393 (1911).

The palp of this curious little species resembles that of *Acudorsum albimanum*, Loman, very closely in structure, the armature of the femur and the shape of the patella being very similar in these two species and somewhat different to what they are in the other species of *Hinzuanus* which I have had the opportunity of examining. In *H. parvulus* the tarsus of the palp is quite as dark as the tibia and there is

no process on the abdominal part of the scutum ; for further characters of this species, see the original description. I am inclined to think that *Acudorsum* is a synonym of *Hinzuanus*.

#### EXPLANATION OF PLATE I.

- Fig. 1.* *Zalmoxis austerus*, sp. n. Outer view of palp.  
*Fig. 1 a.* Ditto. Fourth leg of male, outer view.  
*Fig. 2.* *Vima insignis*, gen. et sp. n. Palp, outer view.  
*Fig. 3.* *Ibalonius quadriguttatus*, sp. n. Chelicera, outer view.  
*Fig. 3 a.* Ditto. Palp, inner view.  
*Fig. 4.* *Podoctis taprobanicus*, sp. n. Anterior end of body and proximal part of first leg, from the side.  
*Fig. 5.* *Podoctis willeyi*, sp. n. Chelicera of male, outer view.  
*Fig. 5 a.* Ditto. Trochanter and femur of first leg, from the side.  
*Fig. 6.* *Baramia vorax*, gen. et sp. n. Palp and anterior end of body, from the side.  
*Fig. 6 a.* Ditto. Chelicera, outer view.  
*Fig. 6 b.* Ditto. Trochanter and femur of first leg, from the side.  
*Fig. 7.* *Epedanus orientalis*, sp. n. Chelicera of male, outer view.  
*Fig. 7 a.* Ditto. Palp, outer view.  
*Fig. 8.* *Epedanus siamensis*, sp. n. Chelicera of male, outer view.  
*Fig. 9.* *Parabiantes longipalpis*, gen. et sp. n. Anterior view of ocular tubercle.  
*Fig. 9 a.* Ditto. Palp, outer view.

#### VIII.—*Hersilia* (*Clausidium*) *vancouverensis*.

By KATHLEEN HADDON.

[Plate II.]

#### *Hersilia* (*Clausidium*) *vancouverensis*, sp. n.

IN the summer of 1911 Mr. F. A. Potts, of Trinity Hall, Cambridge, collected a large number of specimens of *Callianassa pugettensis* from a stretch of sandy beach at Hammond Bay, near Nanaimo, Vancouver Island. A small copepod occurred in vast numbers in the gill-chambers and also all over the body of many of the *Callianassæ*, conspicuous on account of the bright red colour of the egg-sacs. They alternated between a state of quiescence, during which they were attached to the surface of the host, and rapid jerky movements, made when disturbed. The tiny male was attached to the tail of the female in almost every case.

On his return home Mr. Potts gave me the copepod for identification, and I found that it belonged to the genus *Hersilia*.



Apparently only one species, *Hersilia* (*Clausidium*) *apodiformis* (Philippi), has been recorded, and it occurs in the Adriatic and Mediterranean. Dr. Cerruti, of the Zoological Station at Naples, very kindly sent some parasitic copepods from *Callianassa subterranea* which tally with the published descriptions of *Hersilia apodiformis*.

On comparing this species with the one from Vancouver Island, I concluded that the latter presented differences which entailed the formation of a new species; I have hence named it *Hersilia vancouverensis*.

The genus *Hersilia* may be distinguished from the other genera comprising the family Hersiliidae by the following points\* :—

*Hersilia*.—The mandible consists of two accessory pieces besides the tooth (Pl. II. figs. 2 & 2 a).

*Giardella*.—The mandible resembles the above, but the maxillipeds of the male have the distal joint in the form of a long curved claw.

*Hersiliodes*.—The mandible consists of three accessory pieces besides the tooth.

*Specific characters of Hersilia (Clausidium) apodiformis*  
(Philippi).

*Female*.—Length 1.35 mm.

Carapace practically covering abdomen.

Abdomen rather slender.

Antennules depressed, few hairs on anterior margin.

Mandibles bearing a tooth with serrated edges and no hairs (fig. 2 a).

No gap between maxillipeds and first thoracic legs.

Fifth thoracic leg slender, no fine hairs (fig. 3 a).

Infects *Callianassa subterranea*.

*Hab.* The Adriatic and Mediterranean.

*Specific characters of Hersilia (Clausidium) vancouverensis*,  
sp. n. (Pl. II. fig. 1.)

*Female*.—Length 1.6 mm.

Carapace only reaches to last thoracic joint.

Abdomen long and broad.

\* E. Canu, 1888.

Antennules bent upwards, numerous hairs on upper edge.

Mandibles bearing a tooth with smooth edges and having a row of hairs (Pl. II. fig. 2).

Considerable gap between maxillipeds and first thoracic legs.

Fifth thoracic leg broad, with a few fine hairs (fig. 3).

Infects *Callianassa pugettensis*.

*Hab.* Near Nanaimo, Vancouver Island.

The other appendages of the females of the two species are similar.

The males of the two species are alike, except that the antennules are bent as in their respective females and the Vancouver Island form is slightly larger than the one from Naples.

### Literature.

1839. *Hersilia apodiformis*, Philippi. "Einige zoologische Notizen." Archiv für Naturgesch. Tafel iv. figs. 9-11, p. 128.
1840. *Hersilia apodiformis*, Philippi. II. Milne-Edwards, Hist. Nat. des Crustacés, tome iii. pl. xxxvii. fig. 23, p. 417.
1866. *Hersilia apodiformis*, Philippi. C. Heller, "Carcinolog. Beitr. zur Fauna der adriat. Meeres." Verhandl. zool.-bot. Gesellsch. Wien, Bd. xvi. p. 750.
1874. *Clausidium testudo*, Kossmann. "Ueber *Clausidium* . . . &c." Verhandl. phys.-med. Ges. n. F. Bd. vii. Taf. vi.
1875. *Hersilia apodiformis*, Philippi. Claus, "Neue Beiträge z. Kennt. par. Cop." Zeitschr. f. wiss. Zool. Bd. xxv. 1, Taf. xxii.
1888. *Hersilia apodiformis*, Philippi. Canu, "Les Copépodes marins du Boul. (1) iii." Bull. Sc. de la Fr. et de la Belg. iii. sér. 1, t. xix. p. 406.

### EXPLANATION OF PLATE II.

#### Lettering.

*an*=antennule; *an'*=antenna; *l*=lower lip; *m*=mandible; *mx*=maxillule; *mx'*=maxilla; *mxp*=maxilliped; *t*=tooth of mandible; *tel*=telson; *th'*-*th*<sup>5</sup>=thoracic legs 1-5.

*Fig. 1.* *Hersilia vancouverensis*, sp. n. Female, with diminutive male attached to the lower part of the abdomen.

*Fig. 2.* Mandible of *Hersilia vancouverensis*.

*Fig. 2 a.* Mandible of *Hersilia apodiformis* (Philippi).

*Fig. 3.* Fifth thoracic leg of *Hersilia vancouverensis*.

*Fig. 3 a.* Fifth thoracic leg of *Hersilia apodiformis*.

IX.—Descriptions of Ethiopian Rhynchota (Heteroptera).  
By W. L. DISTANT.

## Pentatomidæ.

*Plataspis angolensis*, sp. n.

Above ochraceous, much suffused and punctured with black, on the scutellum the punctures and suffusions obscurely resemble three discal longitudinal fasciæ; head somewhat sparsely blackly punctate, a central black spot on disk and two basal longitudinal spots behind it, the anterior margin centrally subtruncate, obliquely rounded on each side to eyes; pronotum more thickly punctate, the basal area more suffused with black, on anterior area two black-margined transverse spots; outside the basal angles of scutellum a distinct basal orange-yellow spot; scutellum less blackly marked and punctured on the lateral areas and between the pseudo-longitudinal fasciæ on disk; the sternum is subviolaceously opaque; head beneath and sternal margins ochraceous with scattered black punctures; legs, rostrum, and abdomen beneath brighter and darker ochraceous; central fascia to sternum and abdomen, narrow segmental abdominal margins, and a transverse waved fascia to basal segment, black.

Of the size and shape of *P. horvathi*, Hagl., but the anterior margin of the head not centrally sinuous, but evenly continuous.

Long. 10; lat.  $9\frac{1}{2}$  mm.

*Hab.* Angola (Brit. Mus.).

*Myrochea inermis*, sp. n.

Pale ochraceous; head with the margins of the lateral lobes (narrowly) and the margins of the central lobe (broadly) black; pronotum with four longitudinal black fasciæ composed of confluent black punctures, two similar longitudinal black fasciæ to scutellum; corium, excluding lateral marginal area, thickly, sometimes almost confluent blackly punctate; membrane greyish brown; head beneath with a large black spot on each side of base of rostrum, and some black spots at base; pro- and mesonota centrally and sublaterally black; abdomen beneath with a central segmental series of large transverse black spots and with two longitudinal series of black punctures on each lateral area; legs ochraceous; a subapical annulation and apices to femora, the anterior tibiæ,

bases and apices of intermediate and posterior tibiae, and the tarsi, black; rostrum about reaching the posterior coxæ, with its apex black; body oval, somewhat elongate; head rounded anteriorly, the margins moderately laminate and recurved, the lateral lobes a little longer than the central lobe, their apices contiguous; antennæ black, with the apices of the joints more or less ochraceous; second joint a little longer than third, fifth longest; head, pronotum, and scutellum distinctly, somewhat sparsely punctate, corium thickly punctate; lateral margins of the pronotum nearly obliquely straight, moderately laminately recurved; connexivum exposed from near middle of corium, orange-yellow, with black lines at the incisures.

Long. 12 mm.; exp. pronot. angl. 6 mm.

*Hab.* Uganda; between Jinja and Busia or Mbwago's, E. Busoga (*S. A. Neave*, Brit. Mus.).

This species in shape and general markings is closely allied to *M. distincta*, Schout., from which it structurally differs by the lateral angles of the pronotum being subangularly rounded and not acutely produced as in *M. distincta*, the pronotal lateral margins are more obliquely straight and less sinuate, the colour-markings are much darker, but the pattern is indicated in Schouteden's species.

#### *Caura yalana*, sp. n.

Body above black with a slight olivaceous tint; narrow lateral margins to head and a spot at apex of central lobe, lateral margins of pronotum, a spot at base of lateral margins to corium, connexivum, and body beneath, stramineous; apex of scutellum obscurely ochraceous; three spots in transverse series on each side of pro-, meso-, and metasterna, a central longitudinal double series of transverse spots, spiracles and transverse spots attached to them, a more rounded spot between them (two on second segment) to abdomen, bright bluish green; coxæ and trochanters stramineous; legs, rostrum, and antennæ bluish black; second joint of antennæ distinctly shorter than the third, remaining joints mutilated in type; pronotum thickly punctate, with a slight central longitudinal ridge, the lateral posterior angles rounded, non-prominent; scutellum transversely wrinkled and thickly punctate; corium finely punctate; membrane opaque; rostrum reaching the posterior coxæ.

Long. 13 mm.; exp. pronot. angl.  $8\frac{1}{2}$  mm.

*Hab.* Brit. E. Africa, Yala River, S. edge of Kakumga Forest, 4800–5300 feet (*S. A. Neave*, Brit. Mus.).



Allied to *C. intermedia*, Dist., and *C. ovata*, Karsch, but differing from both in having the third joint of the antennæ distinctly longer than the second.

*Damarius bicolor*, sp. n.

Indigo-blue ; head, three spots at apex of scutellum, legs, basal abdominal spine, rostrum excluding apex, a central segmental series of spots, apex of abdomen beneath, and first and second joints of antennæ, sanguineous ; antennæ with the first joint not reaching the apex of head, remaining joints almost subequal in length ; head sparingly punctate, the lateral lobes more or less transversely striate, eyes black ; pronotum thickly, somewhat coarsely punctate, about twice as broad as long, the lateral margins sinuate, the posterior angles subprominent ; scutellum from beyond basal area centrally longitudinally slightly raised and levigate, on each side of which the punctures are thicker and more confluent ; corium smooth, opaque ; membrane shining black, the apical margin greyish white ; rostrum about reaching the posterior coxæ ; ventral spine reaching the intermediate coxæ.

Long. 16 mm. ; exp. pronot. angl.  $6\frac{1}{2}$  mm.

*Hab.* Uganda ; Mabira (*C. C. Gowdey*, Brit. Mus.).

A larger and broader species than *D. splendidulus*, Fabr., the lateral margins of the pronotum considerably less sinuate ; colour-markings very distinct.

*Gonopsis neavei*, sp. n.

Black ; scutellum, meso- and metasterna, abdomen beneath, and posterior suffusions to prosternum pale testaceous, sometimes wholly testaceous ; more than basal half of lateral margin to corium, and the connexivum, ochraceous ; legs, a broad central longitudinal fascia, and apex of abdomen beneath, and small spots near spiracles, black ; membrane obscure greyish ; rostrum either ochraceous suffused with black, or black with ochraceous annulations ; a blackish spot between anterior and intermediate coxæ ; body very elongate ; antennæ black, second joint reaching apex of head, fifth joint slightly longer than fourth and with its apex somewhat obscure castaneous ; head with the lateral lobes long, porrect, coarsely punctate, their apices acute but well separated from each other ; pronotum with the lateral angles longly, acutely, transversely produced, before which the surface is obliquely depressed to head and the lateral margins serrate, the posterior half rugulose ; scutellum a little shorter than head

and pronotum together, transversely wrinkled and sparsely punctate, more thickly so on the posterior half; corium thickly punctate; membrane only slightly passing the basal margin of the posterior abdominal segment; rostrum reaching the anterior coxæ; head beneath ochraceous, with the lateral lobes black; apices of the prosternal lateral spines black; sternum more or less distinctly punctate.

Long.  $17\frac{1}{2}$  mm.; exp. pronot. angl. 10 mm.

*Hab.* Uganda, Eastern Mbale Dist., S. of Mt. Elgon, 3700–3900 feet (*S. A. Neave*, Brit. Mus.).

Allied to *G. maura*, Dist.: pronotal lateral angles longer and more acute; apex of scutellum less rounded and subacute; antennæ black, not ochraceous; apices of the lateral lobes to the head more acute, porrect, and more widely separated.

### Reduviidæ.

#### *Cleontes ugandensis*, sp. n.

Ochraceous; head, antennæ, rostrum, legs, basal and apical areas of abdomen beneath connected by two longitudinal series of spots, anterior lobe of pronotum, apical half and interior lateral area of membrane, inner margin of corium, apical area of connexivum both above and beneath, sublateral fascia to sternum, and the area between intermediate and posterior coxæ, black; coxæ, trochanters, apices of intermediate femora, two broad annulations to posterior femora, and nearly basal half and apex of posterior tibiæ, ochraceous; head laterally longly pilose; pronotum posteriorly longly and broadly produced, completely concealing the scutellum, its apex truncate; abdomen broadly ampliate, the connexivum somewhat strongly recurved, its margins strongly sinuate, its apex truncate.

Long.  $17\frac{1}{2}$ –18 mm.; lat. pronot. angl.  $4\frac{1}{2}$  mm.

*Hab.* Uganda; between Jinga and Busia, E. Busoga (*S. A. Neave*, Brit. Mus.); Mabira (*C. C. Gowdey*, Brit. Mus.).

Allied to *C. genitus*, Dist., but a much larger species; pronotum more posteriorly produced, with its apex truncate, not rounded; connexivum more produced, its apex obliquely truncate and its apical area black; colour-differences distinct.

X. — *A Discussion of the General Classification of the Pelecypoda.* By M. COLLEY MARCH, M.Sc., Geological Department, Manchester University.

[Plate III.]

THE Pelecypoda, like all other animals possessing skeletons, can be classified from the standpoint of their hard or soft parts. The ideal method, where both are taken into consideration, is only available to the palaeontologist when the soft parts leave some trace on the hard.

In the case of the Lamellibranchs, the modern classifications are based on the gills or the teeth. Dall, writing in support of a general hinge classification, said, that as the gills leave no impression on the shell, a gill classification must necessarily exclude all fossil forms, and so do away with the possibility of forming a phylogenetic classification.

It might also be argued that the evolution of gills is not of sufficient taxonomic importance for the division of orders and suborders. It is generally acceded that the pelecypod gill is homogenetic, being evolved from a type in which there was a main rachis giving off hollow and partially flattened leaflets. This type is held to have been developed in the earliest Pelecypoda. The object of specialization in gills and gill-chambers is twofold, to secure the maximum respiratory surface and a separation of the incoming and outgoing currents. These ends have been secured in the Pelecypoda by specialization along one line only, that is by elongation of the leaflets and the upgrowth of the free ends. The junction of these upturned ends has procured the division of the respiratory chamber. Ridewood has shown that in the connections between the opposite sides of the leaflets ciliary junctions preceded organic.

These stages in gill development, then, are of great interest as showing the evolution of the gill, but are useless taxonomically, for they were followed by all lines diverging from the common ancestral stock. They form only transverse divisions across the general classification and can no more be used to subdivide the group than can the articulation of the femur with two or three bones of the pelvis in the Ichthyosauria and Plesiosauria be taken as breaking those groups up into orders and suborders.

Moreover, in general evolution the gills are singularly unaffected by any change in environment or habit such as

leads to the development of new species or genera. Their broad changes must be looked upon as being purely intrinsic and as common to the whole group as such.

On the other hand, the primitive Pelecypod ancestor is conceived to have been hingeless. The evolution of the hinges must therefore have taken place entirely within the group. Its development was due to the necessity for securing rapid and accurate closing of the shell, as was pointed out by Dall. Such an end might be assured in many ways not of necessity related to each other, as the hinge has no ancestral form common to the whole group. So that the development of the hinge apparatus should be of taxonomic value, as similarity of development would show a close relationship between subdivisions, and not merely a common membership in the group. The fact that the variations are extrinsic leads to the occurrence of heterogeneric homœomorphy, but such cases should be distinguishable by the study of ontogeny and phylogeny.

### *Modern Classifications based on the Hinge.*

#### A. NEUMEYER.

Neumeyer was the first, after Martini, to classify the Pelecypoda on the characters of the hinge; he recognized six orders, founded on distinct teeth characters.

1. *Cryptodonta*. Including forms without teeth or with folds which involved the whole thickness of the valve and which were often continuous with the radial ribs.
2. *Taxodonta*. Including forms where, in the simplest cases, the teeth were perpendicular to the hinge-line, but which might become more or less oblique peripherally.
3. *Heterodonta*. Including the most highly specialized of the Lamelli-branches in which the teeth were distinguishable into cardinals and laterals.
4. *Schizodonta*. Including those forms which possess one bifurcated tooth in the left valve, fitting into two divergent lamellæ in the right valve.
5. *Desmodonta*. Including forms very similar to the Heterodonta in anatomy, but with an internal ligament, and teeth not homologous.
6. *Dysodonta*. Containing those Heteromyarians and Monomyarians that have partially or totally reduced teeth.

#### B. FISCHER.

Fischer added a seventh order to Neumeyer's six:—

*Isodonta*, included by Neumeyer in the Desmodonta, contains those forms which have their teeth symmetrically arranged about an internal ligament.



## C. GROBBEN.

Grobben used the hinge in conjunction with other anatomical characters as the basis of his classification. He recognized three sub-classes:—

1. *Protobranchia*, equivalent to the Protobranchia of Pelseneer.
2. *Desmodonta*, equivalent to Neumeyer's order of that name.
3. *Ambonodonta*: (1) Eutaxodonta (Arcidæ).  
                                   (2) Heterodonta (*sensu* Neumeyer).  
                                   (3) Schizodonta (*sensu* Neumeyer).  
                                   (4) Anisomyarians (*sensu* Lamarck).

## D. DALL.

Dall's orders are three in number: Prionodesmacea, Teleodesmacea, and Anomalodesmacea.

The *Prionodesmacea* are described as having hinges which "are the product of evolution applied to the development of (among other things) teeth to the hinge-margin, or of amorphous teeth" (14, p. 452). This, as an isolated quotation, might seem to show that he considered the transverse direction of the Prionodesmacean teeth to be secondary. Quotations from his earlier paper of 1889 will, however, show that in his conception this transverse direction of the teeth was primary.

1. (13, p. 452.) "Attention has been already called to the fact that there can be but three fundamental types of hinge; which may be called anodont, prionodont, and orthodont, the latter term being used to indicate the forms in which the cardinal margin *has become* longitudinally plicate."
2. (13, p. 447.) There are three fundamental types of hinge:—  
     (1) The simple edentulous margin. [Anodont.]  
     (2) The hinge in which the teeth are developed transverse to the cardinal margin. [Prionodont.]  
     (3) The hinge in which the direction of the teeth is parallel to the margin. [Orthodont.]

I am disposed to think that the time relations of the different hinges are those of the order in which I have cited them.

The *Teleodesmacea* include those forms in which the prionodont and orthodont types are combined, the latter being superimposed on the former either by a fusion of the transverse teeth or by the subsequent development of longitudinal teeth.

The *Anomalodesmacea* contain those Pelecypoda in which the dorsal margin is without a distinct hinge-plate, the armature of the hinge being "feeble, often obsolete, or absent."

Dall's three orders, therefore, were made for those Lamellibranchs which have teeth—

- (1) transverse to the hinge-margin;
- (2) parallel to the hinge-margin;
- (3) so degenerate as to show no definite affinity to the other two orders.

The last worker on the hinge from a taxonomic point of view was Bernard. His main work on the subject is found in four papers in the Bull. de la Soc. Géol. de France, two in the 'Comptes Rendus,' and one in the Ann. des Sci. Nat., Zool. This last paper was the first half of a synopsis of his work, and summed up his views on the Taxodonta and Anisomyarians [Dysodonta, Bernard], and included a sketch of the relationships of the modern and Palæozoic forms. He died the year of the publication of this first part, and the second part is not recorded as having been published, although he frequently refers to it in the first part. Consequently he was unable to publish a classification, although the bulk of the material for it was already published, and he never gave his final views on the relationships of the Taxodonta and Anisomyarians [Dysodonta, Bernard] to the Heterodonta. For this reason it is necessary to give a short summary of his work, which leads to the adoption of a classification which, although agreeing largely with Dall's in general grouping, yet differs from it fundamentally in the bases of the classes.

Bernard's main work was confirmed by Munier-Chalmas, and, with the exception of one minor point, by Fischer.

The most important points of Bernard's work are:—

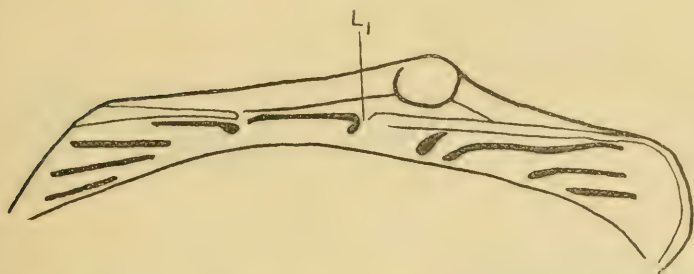
1. The tracing of the ontogenetic development of the taxodont teeth in the Taxodonta proper and also in the Anisomyarians.
2. The tracing of the origin of the taxodont dentition. (This was in part done also by Dall, though he did not grasp the bearing of his work.)
3. The discovery of the existence of an embryonic "dentition" in the Taxodonta equivalent to that found in some Heterodonta.
4. The tracing of the development of the heterodont hinge.

#### *The Development of Pleurodont [Taxodont and Dysodont] Teeth.*

The taxodont dentition was taken by workers previous to Bernard to differ essentially from the heterodont (Teleodesmcean, Dall) hinge, in having the teeth developed in a direction essentially *perpendicular* to the hinge-line instead of *parallel* to it. Bernard clearly demonstrated that in the prodissoconch stages, and sometimes continuing into dissoconch stages, there is an embryonic "dentition" consisting

of alternating ridges and folds, called by him "crenulations." This band is separated into anterior and posterior portions by the primary ligamental pit. In *Ostrea*, however, the anterior row is wanting, and the ligamental pit lies at the anterior edge of the shell. Subsequent to the development of the crenulations the true teeth make their appearance. These arise, not perpendicular to the hinge-line but as long ridges parallel to it. They may retain this position throughout life, as in *Cucullea crassatina*. Usually, however, the interior end becomes sharply curved and the external part atrophies, leaving the usual taxodont teeth (figs. 1, 2, and 3).

Fig. 1.



Young *Cucullea crassatina*, showing the recurving of the primitive lamellæ to form taxodont teeth. (After Bernard.)

$L_1$  = primary ligamental teeth.

The great importance of this is twofold :—

*Firstly.* It refutes the theory that the early embryonic dentition seen in certain Heterodonts, and which arises perpendicular to the hinge-line, represents an early taxodont condition, and for that reason necessitates the descent of the Heterodonts from Taxodonts as seen in modern forms.

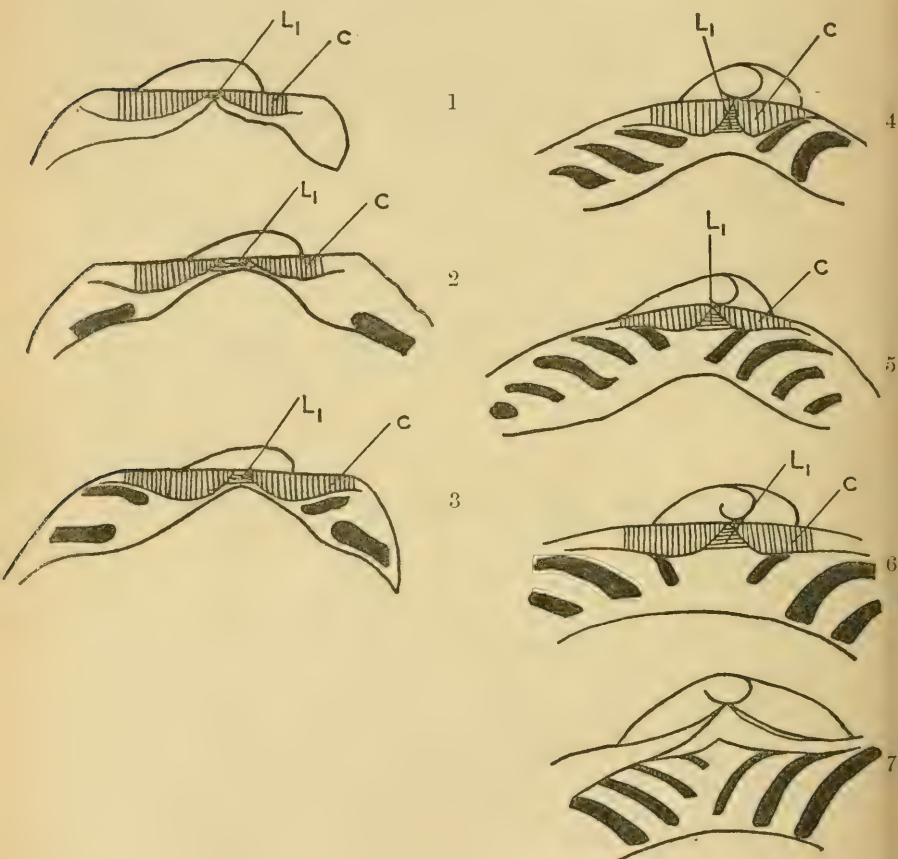
*Secondly.* It does away with the radical difference between the heterodont and taxodont teeth.

#### *The Origin of the Pleurodont Dentition.*

Amongst the Anisomyarians (figs. 4 & 5) the teeth show a still earlier stage than in the Nuculidæ and their allies. Here they rise before the development of the cardinal plateau as lateral folds alternating with the external ribs. These internal ribs may occur where the outer test is smooth. In forms where the test thickens greatly a transition can be

traced from a period when these internal ribs alternate with the external ribs, and a time when they are entirely independent of them. The cardinal plateau is a subsequent development to the first-formed teeth and arises on them.

Fig. 2.



Development of *Pectunculus obovatus*. (After Bernard.)

1 & 2, right valve; 3-7, left valve.  $L_1$ =primary ligamental pit;  
 $C$ =band of crenulations.

Where these first-formed teeth remain as internal ribs they are called "dysodont," when they are developed on the plateau, or take their place on it, they become true taxodont teeth, and as such become capable of growth into the usual



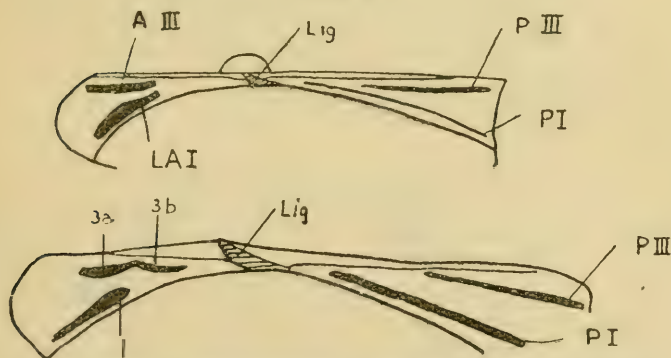
taxodont form. Dall noticed the same origin for the Anisomyarian teeth; but he read it as excluding them from any connection with the Taxodonta, whose teeth he

Fig. 3.

Young stages of *Arca*. (After Bernard.)

C=band of crenulations;  $L_1$ =primary ligamental pit; L=ligament.

Fig. 4.

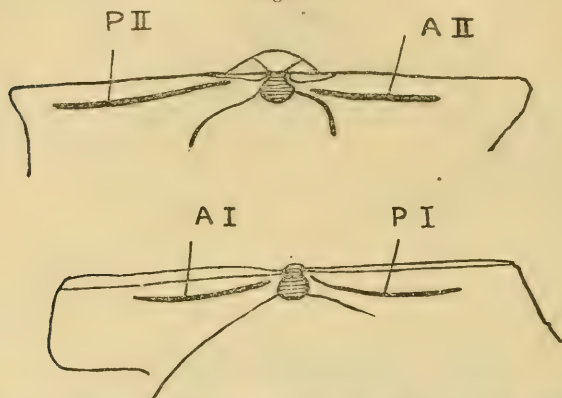


*Avicula microptera* (after Bernard), showing the dysodont teeth, which anteriorly show a tendency to produce cardinals.

conceived as arising perpendicular to the hinge-line. Confirming the fact that the dysodont stage precedes the taxodont, Bernard cites the case of the development of those young

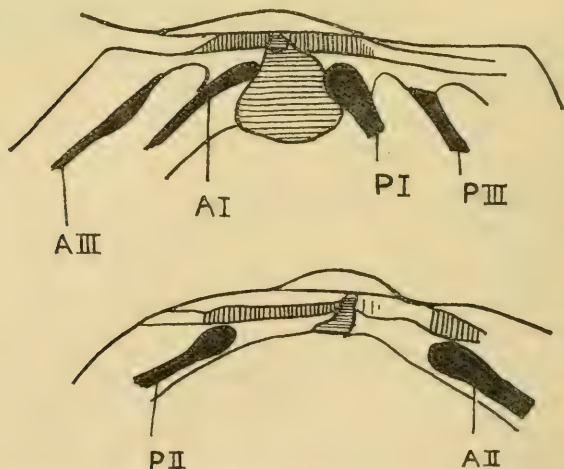
Arcidæ which grow slowly and have a thin test. Here the transition between dysodont and taxodont teeth is clearly seen. The Monomyarians develop rudimentary dysodont

Fig. 5.



*Pecten varius*, showing the first dysodont teeth. (After Bernard.)

Fig. 6.



*Plicatula ramosa*, showing the development of I, II, and III. (After Bernard.)

teeth, which show extraordinary variation. Bernard concludes from these facts that they are degenerate.

An important fact brought out by Bernard is the order of

development of teeth in the Taxodonta. The later teeth in the Taxodonta appear ventrally except:—

- (a) In the case of the Pectunculidæ, where the third tooth in the left valve appears dorsally to the first and second teeth. This may possibly be a case of degeneration, Bernard, however, does not suggest this (3, p. 61). (Fig. 6.)
- (b) In *Nucula* (3, p. 166) two teeth appear dorsally, which Bernard takes as being developed in their normal order. He comments, however, on their irregularity. In the case of the Monomyarians the irregularity in the development of the dysodont teeth is taken by him as postulating degeneration, so that these dorsal teeth might possibly be degenerate. In both these cases the other teeth develop ventrally.
- (c) In the Pectinidæ and Spondylidæ, and also in *Mytilus*, the teeth develop dorsally.

So far the points established by Bernard are:—

- (1) That the Taxodonta (*i. e.* Prionodesmacea—Naiadacea) have an embryonic dentition which is also seen in some Heterodonta (*i. e.* Teleodesmacea + Anomalodesmacea + Naiadacea).
- (2) That the true taxodont dentition develops parallel to the hinge and that its position perpendicular to the cardinal line is due to rotation.
- (3) That the dysodont dentition of the Anisomyarians is an early stage in the development of the taxodont and is originally formed from internal ribs, alternating with external ribs when these are present.

### *The Development of the Heterodont Dentition.*

The last great point brought out by Bernard is the development of the heterodont teeth. These may or may not show the embryonic crenulations. In either case the true teeth are developed on a common plan.

The teeth, lateral or cardinal, are developed from laminæ running parallel to the edge of the cardinal plateau. Those of the right valve lie ventral to those of the left valve. They are numbered I, II, III, IV, V, VI, from ventral to dorsal, those of the left valve being denoted by the even numbers, and those of the right valve by the odd numbers. As before, there are two sets of these teeth, one lying anterior, and the other posterior, to the ligament-pit,

Anterior to the ligament :—

LA I, LA III, LA V, for the right valve.

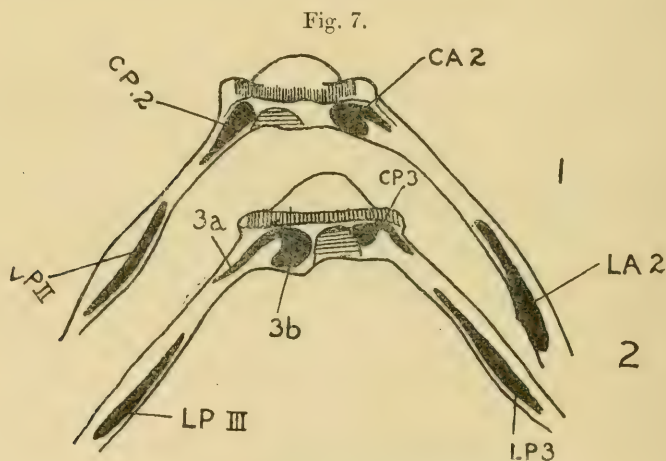
LA II, LA IV, LA VI, for the left valve.

Posterior to the ligament :—

LP I, LP III, LP V, for the right valve.

LP II, LP IV, LP VI, for the left valve.

The posterior ends of these lamellæ bend round so as to lie more or less perpendicular to the hinge-line, and may become differentiated from the anterior part. The posterior portions form the cardinals, the anterior portions form the lateral teeth or remain as undifferentiated lamellæ. The posterior lamellæ are unaltered except in the case of *Condylocardia* (fig. 7). The anterior cardinals may become bifurcated forming anterior portions.



*Condylocardia crassicosta* (after Bernard), showing the occurrence of posterior cardinals.

1. Left valve. 2. Right valve.

The reduction of the heterodont hinge to a scheme, and the cursory comparison of that scheme with the actual adult heterodont hinge, makes the conception seem too simple to be really possible. It is only by carefully following out Bernard's papers, and by the comparison of his descriptions of the adult shells with the actual specimens that it becomes clear that the hinges do develop on that plan. In actual practice V appears rarely, and VI very rarely.



LP=lateral posterior lamella.

LA=lateral anterior lamella.

CA=anterior cardinal.

*a*=anterior portion of an anterior cardinal.

*b*=posterior portion of an anterior cardinal.

*Left valve.*

*Right valve.*

LP VI *ligt.* LA VI

LA V *ligt.* LP V

**A.** LP IV *ligt.* LA IV

LA III *ligt.* LP III

LP II *ligt.* LA II

LA I *ligt.* LP I

LP VI *ligt.* CA 6 LA VI

LA V CA 5 *ligt.* LP V

**B.** LP IV *ligt.* CA 4 LA IV

LA III CA 3 *ligt.* LP III

LP II *ligt.* CA 2 LA II

LA I CA 1 *ligt.* LP I

LP VI *ligt.* 6 b 6 a LA VI

LA V 5 a 5 b *ligt.* LP V

**C.** LP IV *ligt.* 4 b 4 a LA IV

LA III 3 a 3 b *ligt.* LP III

LP II *ligt.* 2 b 2 a LA II

LA I CA 1 *ligt.* LP I

Diagrams showing the relation of the teeth  
according to Bernard.

**A.** Stage showing primary lamellæ only.

**B.** Stage showing development of anterior cardinals and laterals.

**C.** Stage showing bifurcation of the anterior cardinals.

Bernard provisionally divided the Heterodonta into two classes. He did not hold these classes to be strictly natural ones, but he made them for the sake of convenience.

### *Subdivisions of the Heterodonta.*

**A.** The *Cyrina* type, where the CA I is present, and CA II is divided into 2 *a* and 2 *b*.

**B.** The *Lucina* type, where the first cardinal is undeveloped and the second cardinal is consequently simple.

### *Families in Bernard's Orders and Suborders.*

#### **Heterodonta.**

##### **PLIODONTA.**

*Mactridæ*: Mactra, Schizodesma, Lutraria, Merope,  
Schizothærus, Eastonia, Raëta.

*Scrobicularidæ*: Cumingia, Semele, Scrobicularia.

- Mesodesmatidæ* : Paphia (= Mesodesma), Anapa.  
*Cardiliidæ* : Cardilia.  
*Anatinidæ* : Anatina, Thracia.  
*Cuspidariidæ* : Cuspidaria.  
*Cyrenidæ* : Corbicula, Iphigenia, Cyrena, Sphærium, Cyrenoida, Velonta.  
*Rangidæ* : Rangia.  
*Veneridæ* : Cytherea, Venus, Tapes, Circe, Macrocallista, Dosina, Glaucomya.  
*Cyprinidæ* : Cyprina, Pygocardia, Cypricardia, Corallio-phaga.  
*Isocardiidæ* : Isocardia, Modiolaria.  
*Petricolidæ* : Petricola.  
*Erycinidæ* : Lascea, Kellya, Bornea, Scacchia, Montacuta.  
*Kelliellidæ* : Lutetia, Kelliella.  
*Chamidæ* : Chama, Echinochama, Gyropleura, Monopleura, Capratina.  
*Rudistæ* : Valletia, Radiolites.  
*Diceratidæ* : Dicerias, Heterodicerias.

## OLIGODONTA.

- Lucinidæ* : Lucina, Fimbria, Diplodonta, Axinus, Felania, Ungulina.  
*Astartidæ* : Astarte.  
*Condylocardiidæ* : Condylocardia.  
*Cardiidæ* : Cardium, Hemicardium, Pterocardium, Prosodacna.  
*Donacidæ* : Donax.  
*Corbulidæ* : Corbula, Mya, Sphenia, Tugonia.  
*Tellinidæ* : Tellina.  
*Solenidæ*.  
*Panopeidæ*.  
*Pholadidæ* : Pholas.  
*Dreissensidæ* : Dreissensia.  
 \* *Trigoniidæ* ; Trigonina.

## Pleurodonta.

## TAXODONTA.

- Nuculidæ* : Nucula.  
*Arcidæ* : Arca, Cucullea.  
*Pectunculidæ* : Pectunculus.  
*Ledidæ* : Leda, Yoldia, Malletia.

## DYSODONTA.

- Mytilidæ* : Mytilus, Modiola, Modiolaria, Crenella, Lithodomus, Hochstetteria.  
*Aviculidæ* : Avicula.  
*Pectinidæ* : Pecten, Lima.  
*Spondylidæ* : Spondylus, Plicatula.  
*Anomiidæ* : Placunanomia.  
*Ostreidæ* : Ostrea.

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\* Possibly may belong to the Pliodonta.

*Bernard's Classification.*

Bernard's discovery of the discontinuity of the embryonic and adult dentitions of the Taxodonta, and his working out of the development of the definitive teeth, overthrew the hypothesis that the crenulations observable in certain Heterodonta postulated the descent of the latter from the former. On the other hand, he regarded the Heterodonta as being derived from an early taxodont (*i. e.* dysodont) ancestry by the specialization of the lateral lamellæ—that is to say, he considered these lamellæ to be homologous in both groups, for he says:—

“Pour comparer la charnière des Hétérodontes à celle des Taxodontes, il sera nécessaire de s'adresser, non pas aux formes adultes mais aux formes embryoniques . . . Une dent des Taxodontes sera homologue non pas à l'une quelconque des dents Hétérodontes adultes mais à l'une de leurs lamelles primitives qui se recourbent . . . pourra donner naissance, suivant les cas à 1, 2, ou 3 dents définitives.”

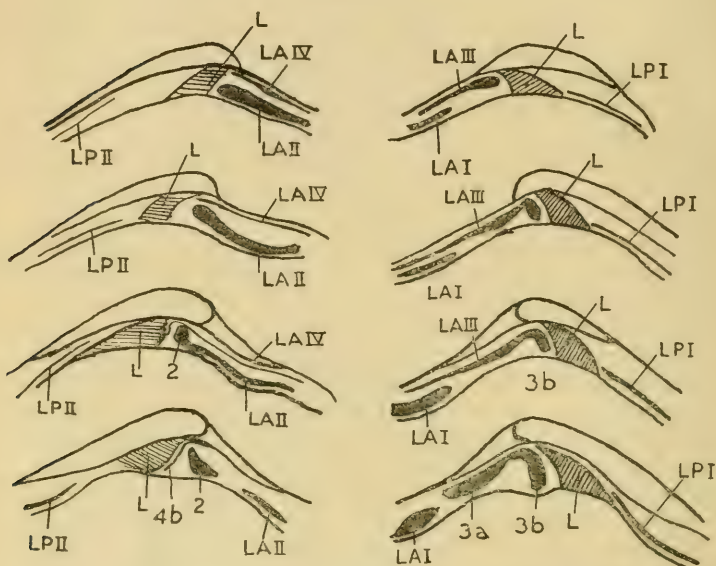
In his work Bernard clearly states that the Taxodonta and Anisomyaria form one group, the latter showing clearly the evolution of taxodont teeth from internal ribs. This is also shown by the *Arcas* in the former group. The Anisomyaria show the beginning of the taxodont dentition, but not its full development. The Monomyarian dentition he shows to be degenerate—indeed, *Ostrea* never passes through a taxodont stage. The absence of a well-developed taxodont stage may of course be due either to want of phylogenetic development or to a similar degeneration. Into this point Bernard does not go. The evidence of the Monomyaria and the specialized habit of the Anisomyaria generally point to its non-development being due to degeneration. That this loss of later specialization threw more and more work on to earlier stages is shown by *Ostrea*, which, never passing through a taxodont stage, has embryonic crenulations persisting late.

As the Taxodonta and Anisomyaria are included in one order, that order cannot very well be called Taxodonta. A name which seems suitable is Pleurodonta, as it refers to the definite proof of the evolution of the taxodont teeth from internal ribs. As to the names of the two suborders, Taxodonta is perfectly suitable; but the name Anisomyaria cannot very well stand, as it seems to show an order in a general classification based on the considerations of the hinge, divided off because of its muscular characters. For the

teeth of this suborder Bernard retains the name dysodont, therefore it might be called the Dysodonta.

The second order Bernard called Heterodonta. Its two main subdivisions he based on the fact that in one type cardinal 1 is not differentiated from lamella 1, and therefore

Fig. 8.

Development of *Lucina neglecta*. (After Bernard.)

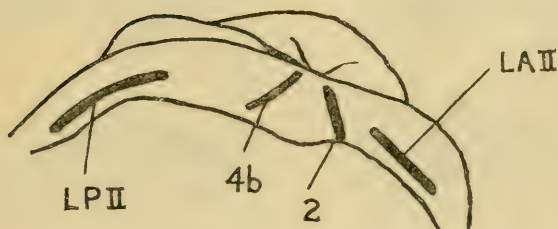
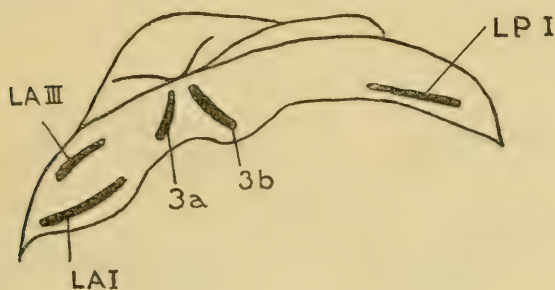
cardinal 2 is undivided. In the other type cardinal 1 is present and cardinal 2 is divided. These two suborders might perhaps be called Pliodonta and Oligodonta (figs. 8 & 9), in reference to their diagnostic characters. The former suborder is again divided into four classes :—

1. Containing those forms which are typical of the suborder (figs. 10 & 11).
2. Containing those forms in which CA 1 is either quite undeveloped or not strongly developed (fig. 12).
3. Containing those forms in which the ligament is either entirely or nearly internal and where CA 1 is undeveloped (figs. 13 & 14).
4. Containing *Chama* and its allies (fig. 15).



There are two apparent objections to Bernard's conclusions. The first is Noettling's (17, p. 87), who, in criticizing Bernard's statement that the dorsal primary lamellæ of the Heterodonta appear later than the ventral ones, says:—"The view that the dorsal primary lamellæ are older than the ventral ones is . . . supported by the fact that the Bivalves grow in a ventral direction—in other words, the ventral portions of a bivalve shell are younger than the

Fig. 9.

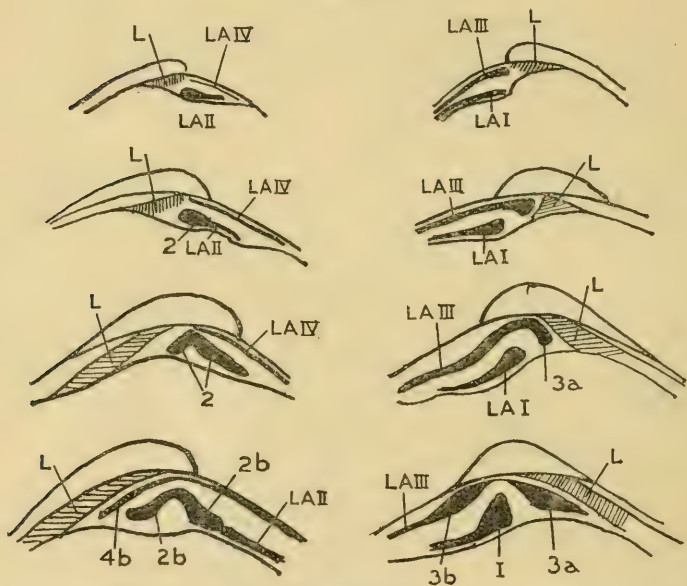
*Cardium.*

dorsal ones; it would be certainly strange if the opposite took place with regard to the hinge, where the ventral parts would be the older and the dorsal parts the younger ones—that is to say, the hinge would grow just in the opposite direction to the remainder of the shell." This certainly would be strange, but Dr. Noettling overlooks three facts:—

*Firstly.* That, as is shown by the growth-lines, the teeth are formed entirely by secondary thickening which may take place at any point.

*Secondly.* The growth-lines in the umbonal region of the shell show that the earliest formed part of the plateau is due to internal thickening. The first growth-line bends down, then up, cutting the edge of the young shell. If the plateau were formed by downgrowth of the external part the growth-lines would run towards the umbonal region as they do in the underpart of the plateau. If, then, as seems probable from the structure of the shell, the plateau is due to secondary thickening, it cannot be possible to speak of teeth as being dorsal or ventral with regard to each other

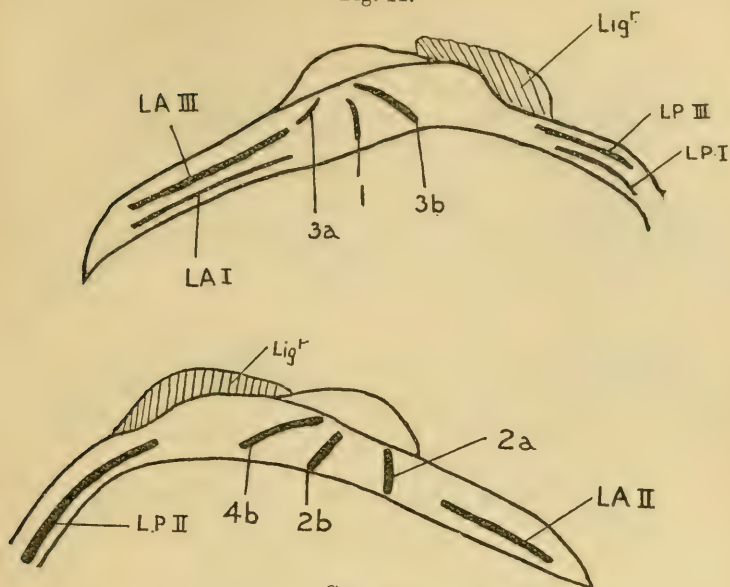
Fig. 10.

Development of *Cytherea deshayesiana*. (After Bernard.)

when they are formed by thickenings on its upper surface. They can only be more or less internal or external with regard to each other.

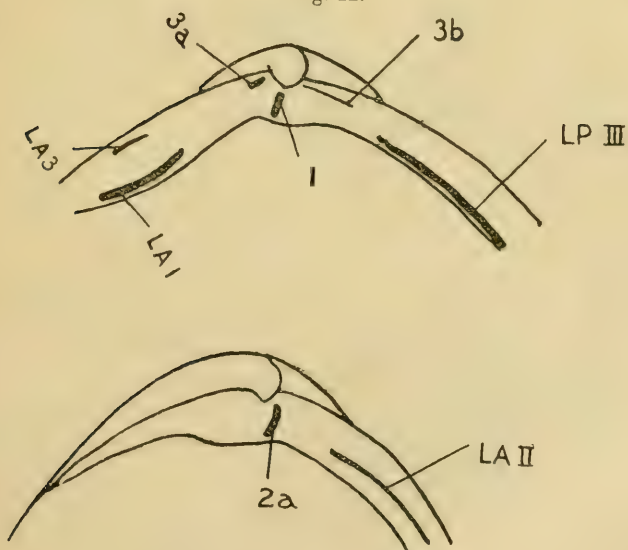
*Thirdly.* According to Bernard's hypothesis, the lamellæ are derived from radial internal ribs, which, except for intercalation (which only occurs in later shell-development), remain constant in number and normally develop simultaneously. Such ribs cannot be regarded as dorsal or ventral with regard to each other.

Fig. 11.



*Cyrena.*

Fig. 12.



A *Lævicardium* with reduced teeth.

Fig. 13.

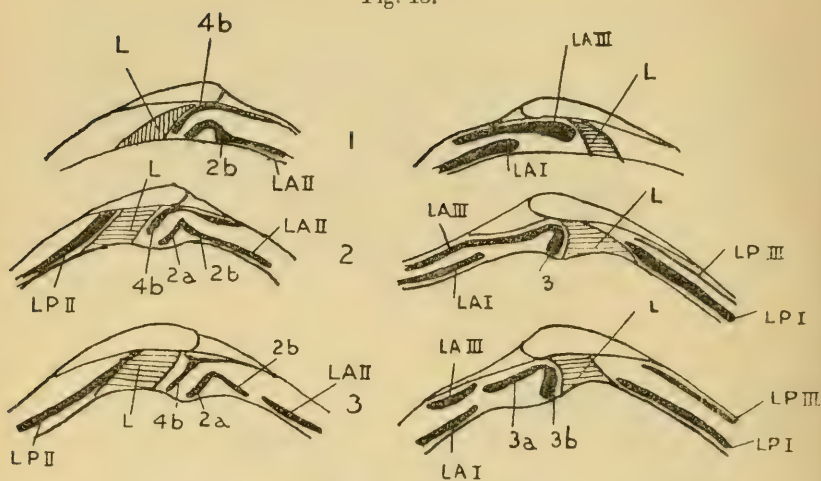
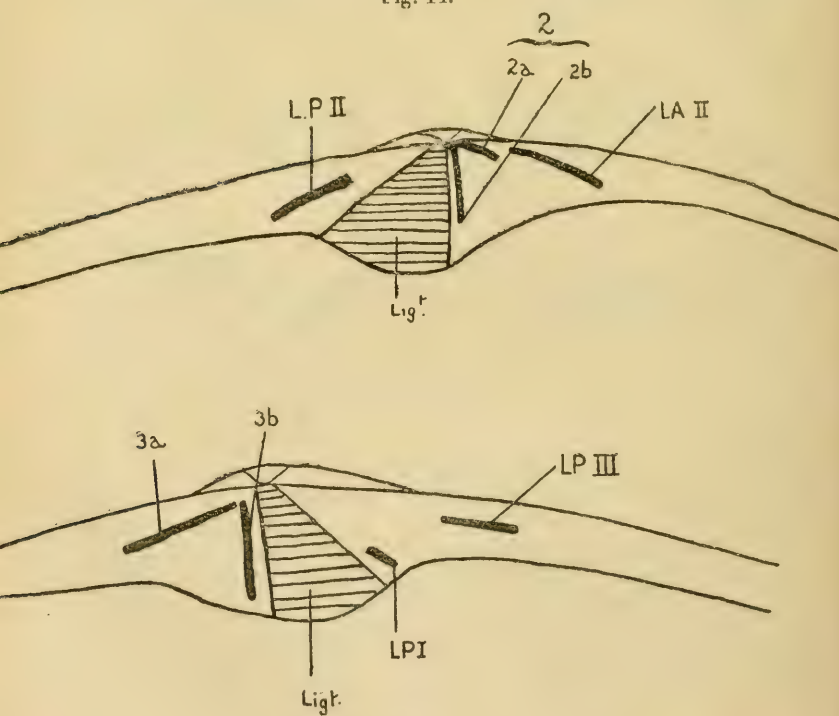
Development of *Mactra solida*. (After Bernard.)

Fig. 14.

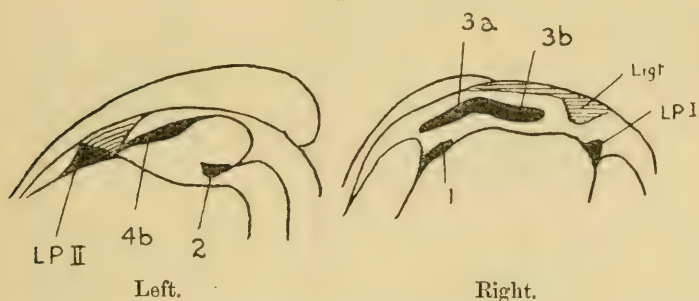
*Lutraria*.



Those ribs would then be developed which were of greatest importance to the shell—they might be those nearest to the hinge-line or those furthest from it.

The second apparent objection is the alteration of a ventral succession in the Taxodonta and some Dysodonta to a dorsal one in the remaining Dysodonta and all the Heterodonta if, as seems probable, they have a common origin. This objection has already been partially answered, where it was stated that those ribs which were most important would develop first. The change in order of development, then, may merely mean a change in the relative importance of the upper and lower ribs. This may reasonably be accounted for on the

Fig. 15.



*Chama lazarus.* (After Bernard.)

firmly established principle that those parts of an organism most highly developed in the adult tend to appear first in ontogeny. In the early shells, the Palæoconchs, the shells were thin and would be likely to break under the strain of the ligament. The most external, that is the uppermost ribs, which are more than mere valleys between the external ribs, and, moreover, need not be associated with external ribs, would be extremely likely to be useful as helping to strengthen that part of the shell. Being more developed they would appear sooner than the less important ventral ones. After the appearance of the cardinal plateau, or even after the general thickening of the shell, this use would be subordinated to the use of guiding the shell to ensure rapid and accurate closing. This would be better accomplished by ventral ribs, which would then develop first.

Noetting reasons from diagrams 12, numbers 2 and 3 (see text-fig. 10), of Bernard's work on Heterodonts, that lamella III, which is shown as curved round, is more differentiated

<i>Bernard.</i>	<i>Family.</i>	<i>Dall.</i>	<i>Ridewood.</i>
Order I. <b>Pleurodonta.</b>			
Suborder A. <b>DYSODONTA.</b>	Mytilidæ. Aviculidæ. Pernidæ. Pectinidæ. Spondylidæ. Anomiidæ. Ostreidæ.	Prionodesmacea Dysodonta. " Scizodonta. " Isodonta. " " Dysodonta. " Isodonta. "	Eleutherohabda Mytilacea. " Pectinacea. " " " " " " Synaptorhabda Ostracea.
Suborder B. <b>TAXODONTA.</b>	Pectunculidæ. Aridæ. Nuculidæ. Lolidæ.	Prionodesmacea Taxodonta. " " " " " "	Eleutherohabda Mytilacea. " " Protobranchia. "
Order II. <b>Heterodonta.</b>			
Division A. <b>PLIODONTA.</b>	Maclridæ. Scrobiculidæ. Mesodesmatidæ. Cuspidariidæ. Cardiliidæ. Anatenidæ.	Teleodontesmacea Teleodonta. " included in the Se- melidæ. " Teleodonta. " " " " Anomalodesmacea Adelosiphonia.	Synaptorhabda Tellinacea. " " " " " " " " " Poromyacea. " Anatinacea.

Division B. OLIGODONTA.		
Cyrenidæ.	Teleodesmacea Diogenodonta.	"
Cypicardiidæ.	"	Submytilacea.
Petricolidæ.	Teleodonta.	"
Erycinidæ.	Diogenodonta in fam.	
	Leptonidæ.	
Kelliellidæ.	Diogenodonta.	
Sphaeridæ.	"	Synaptorhabda Cardiacea.
Chamidæ.	Teleodonta.	"
Rudistæ.	"	
Diceratidæ.	Diogenodonta.	
Astartidæ.	Teleodonta Diogenodonta.	Synaptorhabda Submytilacea.
Lucinidæ.	"	"
Carditidæ.	"	"
Condyllocardiidæ.	"	"
Cardiidæ.	Cyclodonta.	"
Crassatellidæ.	Diogenodonta.	"
Solenidæ.	Teleodonta.	Myacea.
Pholadidæ.	Asthenodonta.	Pholadacea.
Tellinidæ.	Teleodonta.	Tellinacea.
Corbulidæ.	Asthenodonta.	
Donacidæ.	Teleodonta.	"
Dreissensiidæ.	Prionodesmacea Schizodonta.	Submytilacea.
Cardiniidæ.	"	
Trigoniidæ.	"	Eleutherorhabda Mytilacea.

than lamella I, which is merely a straight ridge. Surely here he is confusing the appearance of teeth and lamellæ. The curving of III is the first stage in the development of 3 *a* and 3 *b*. Lamella I might appear before lamella III, and yet CA 3 be developed before I. Indeed, CA I may never develop. Also the early appearance of I causes II in the left valve to appear more or less curved, and this enjoins the same fate on III in the right valve. As a matter of fact, this reading of these diagrams supports the assumed change in order of development by showing that, although the first lamella to develop is the most internal, yet the earliest formed teeth appear more externally.

### Order I. PLEURODONTA.

Pelecypoda in which the prodissoconch stage always shows an embryonic dentition in the form of crenulations, which may or may not continue into the dissoconch stage. The true teeth normally develop as lateral folds at the periphery. The cases in which they do not may be taken as due to acceleration in development. The succession of teeth is normally from external (dorsal) to internal (ventral). The cardinal plateau develops after the first-formed teeth, which may or may not be traceable from internal ribs. The teeth when developing before the plateau are dysodont, when developing on the plateau they are taxodont. The teeth tend to become curved, so as to lie perpendicular to the hinge-line internally. Peripherally they tend to atrophy.

#### Suborder A. DYSODONTA.

Pleurodonta in which the teeth definitely arise as continuations of internal ribs. They are reduced in number and may become taxodont in nature or degenerate. The succession may be external (dorsal).

#### Suborder B. TAXODONTA.

Pleurodonta in which the origin of teeth from internal ribs is normally not evident. The teeth are numerous and become perpendicular to the hinge-line. The succession is internal (ventral), except where not more than two teeth arise externally (dorsally).



## Order II. HETERODONTA.

Pelecypoda in which the prodissoconch normally shows no embryonic crenulations. The teeth develop from lateral lamellæ. The succession is external (dorsal). The first-formed lamella is in the right valve. Each valve contains lamellæ in front of and behind the ligament. The anterior lamellæ may develop posteriorly into cardinal teeth and anteriorly into lateral teeth. Posterior cardinals are developed in one case only.

## Division A. PLIODONTA.

Heterodonta in which CA 1 is developed and CA 2 is subdivided into anterior and posterior portions.

## Division B. OLIGODONTA.

Heterodonta in which CA 1 does not develop and CA 2 remains undivided.

*Conclusion.*

The comparison and contrasts between these three classifications stand out clearly. To Neumeyer, the first to really tackle the problem of the hinge as a basis for classification, is due the honour of having divided the hinges into types. Three only of these divisions survive, two of these only as of subordinal value (Taxodonta and Dysodonta), the third (Heterodonta) as an order; but to him is due the general basis for such a classification. Dall kept these types of Neumeyer's, but reduced them to the rank of divisions in his orders. He created three new orders, founding them, as did Neumeyer, on the characters of the adult shell, and, as was shown by Bernard's later work, erroneously. Bernard's work was essentially that of an embryologist. His two orders and their suborders were founded on the study of individual development. Having worked out the main lines of his classification in this way, he compared it with Neumeyer's work on the Palæoconchs of the Palæozoic period, and found that the results of his work were borne out by these earlier researches.

Neither of these workers claimed that his work was ideal phylogenetically; each fully realized the importance of the consideration of other organs in tracing out the relationships of members of the group.

Neumeyer's seven orders bear no distinct relationship to the orders established by those who followed the differentiation of the gills. Dall's first order, *Prionodesmacea*, corresponds to the *Protobranchia* and *Eleutherobranchia* of Ridewood, except that *Ostrea* and *Pinna* are removed by the latter, on account of their gills, into the *Synaptorhabda*, which is equivalent to the *Anomalodesmacea* and *Teleodesmacea* of Dall, with the exception of the above-mentioned families.

Bernard's *Pleurodonta* includes the members of the *Protobranchia* and *Eleutherorhabda*, together with the *Ostreidæ* and the *Pinnidæ* placed in it, and without the *Cardiniidæ* and *Trigoniidæ*. His *Heterodonta* agrees with the *Synaptorhabda* with these two families removed and the *Trigoniidæ* and *Cardiniidæ* added.

Grobben's classification appears to be untenable for three reasons :—

- A. He separates the *Desmodonta* from the *Heterodonta*, placing them in a different order, although they are essentially similar in both the gills and the hinge.
- B. He separates the *Arcidæ* from the other *Taxodonta*, placing them in the same order as the *Heterodonta*, although they differ in development and history.
- C. In spite of the same difficulty, he places the *Anisomyarians* with the *Heterodonta*.

As Dall's orders have been shown to have been founded on a misconception of the value of the teeth, the only important comparisons are between Bernard's and Ridewood's classifications.

One of the differences between these classifications is the inclusion in the first of Bernard's orders of the first two of Ridewood's orders. Bernard's reasons for putting the *Taxodonta* and *Dysodonta* together are :—

1. They have a similar prodissoconch with embryonic crenulations.
2. The early dissoconch stages are similar in regard to the development of the teeth and cardinal plateau.

The differences in their later development justifies their separation into suborders.

Ridewood's reason for separating them is that the gills in one case are simple protobranchs and in the other they are recurved. Ridewood himself derives the filibranch type

from the protobranch, so that the difference is merely one of degree of development, while Bernard's comparisons imply a relationship of origin and development for the prodissoconch and early dissoconch stages. The reasons for the association of these two sections of the Pelecypoda seem to be stronger than the reason for their separation.

Of course it can be urged against Bernard's order that in the Pectinidæ, Spondylidæ, and Plicatulidæ the order of development of the teeth is towards the exterior (*i. e.* the dorsal side), but a foreshadowing of this may be seen in the Nuculidæ and Pectunculidæ.

The separation of *Ostrea* and *Pinna* from *Avicula* on account of the gills is opposed to the results of the researches of Jackson on the Aviculidæ and their allies, and of Bernard on the development of the hinge and the general characters of the shell.

The inclusion of the Trigonacea in the Heterodonta, which is another difference, as the Heterodonta are practically equivalent to the Synaptorhabda, is another point of difference. This position of this family resolves itself into the question of whether the teeth or the gills are taken as being the more important for classification. The arguments on this point were given at the beginning of this paper.

A third and more important point of difference is the inclusion by Ridewood of the Arcidæ with the Trigoniidæ and Mytilidæ in the subgroup Mytilacea. This arrangement is opposed to the results of both phylogeny and ontogeny. The types of hinge which these families possess were distinct at any rate in Ordovician times.

In general basis Bernard's classification is sounder than Ridewood's, because it is possible to include in it fossil forms and also because it is not based on the degree of development of a common character. Where the two disagree in detail Bernard's views are supported by other workers and by phylogeny and ontogeny. Moreover, Bernard's conclusions are the result of the detailed study of ontogeny.

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## EXPLANATION OF PLATE III.

- A. 1. Left valve of *Meretrix*.  
2. Right " "
- B. 1. Left valve of *Macra*.  
2. Right " "
- C. 1. Left valve of *Lucina*.  
2. Right " "
- D. 1. Left valve of *Pecten*.  
2. Right " "
- E. 1. Left valve of *Pectunculus*.  
2. Right " "

LA=anterior lamella.

LP=posterior lamella.

1, 2 *a*, 2 *b*, &c.=cardinal teeth.

A=anterior dysodont tooth.

P=posterior dysodont tooth.



XI.—Notes from the Gatty Marine Laboratory, St. Andrews.  
—No. XXXIII. By Prof. M'INTOSH, M.D., LL.D.,  
F.R.S., &c.

[Plates IV. & V.]

1. On a White Porpoise.
2. On the Spawning of the Hake (*Merluccius merluccius*, L.).
3. On *Eteone depressa*, Mgrn., var., a Species not hitherto found in Britain.
4. On *Nereis zonata*, Mgrn., in Britain.
5. On the British *Capitellidæ* (*Helminthidæ*).
6. On the *Capitellidæ* procured by H.M.S. 'Porcupine.'

1. *On a White Porpoise.*

For nearly a fortnight amateur fishermen who used the hand-lines at night were surprised to see about the beginning of August a whitish porpoise, or, as some thought, a *Beluga*, disporting itself in St. Andrews Bay, and it was also observed by the salmon fishermen early in the morning. It was never in company with its neighbours, but was always solitary. On the morning of the 10th August it was entangled in the salmon stake-nets off Kinkell Ness, about two miles from St. Andrews. When brought to the Laboratory it was found to be a young female measuring 34 inches in length (Pl. IV.) and was of a dull yellowish white all over like that of *Beluga*, though when carefully examined a faint longitudinal band occurred along the upper lateral region on each side. In front of the eye, again, a curved band of a blackish hue passed from the vertex forward, made a bold sweep forward, and then curved backward to the angle of the mouth. The shape of the entire patch was somewhat crescentic, the dark pigment being toned off at the margin. The eyes had the normal pigment, and thus differed from those of an albino.

Though it is rare to find any noteworthy change in the blackish pigment of the dorsum of the porpoise, variations occasionally occur in the hue of the latero-ventral and the ventral surface in the form of pale or greyish pigment or dull streaks. Again, in a foetal porpoise about 6 inches in length (18th November, 1911) the anterior region of the head, the vertex to a line with the perpendicular from the anterior base of the flipper was dark, and the entire dorso-lateral region to the tail was of a dull grey hue. The under surface and the ventro-lateral regions were pale. The flippers, dorsal fin, and the caudal flukes were blackish, the pigment on the latter being densest ventrally. In another

fœtus between 16 and 17 inches in length (6th February) the pigment outlined in the early example had become of a deep black hue—fading at the edges to the pale tint of the ventro-lateral region. Thus in the white form traces of embryonic hues have been retained.

Variations in colour are known in other Cetaceans, such as the humpback whales, schools of which have the belly nearly white, others with a marbled under surface, and a third series with the bellies entirely dark\*. Similar variations are noted by the old authors, by Prof. Collett† and Mr. Lillie‡, amongst the rorquals (*Balenoptera musculus*, *B. sibbaldii*, and *B. borealis*). In remarking on three variations—viz., dark and two lighter-coloured phases—Mr. Lydekker§ is inclined to think these are not due to race but to age. So far as observed, however, the common cetaceans of Britain do not appear to lend much support to this view, or to the statement that the dark-tailed rorquals specially feed on herrings and pilchards and the lighter-coloured forms on crustaceans.

## 2. *On the Spawning of the Hake* (*Merluccius merluccius*, L.).

The hake is by no means a common fish on the eastern shores of Scotland, indeed Parnell|| states that “it is seldom met with on the east coast of Scotland. About two years ago, a single specimen was taken in a stake-net at Musselburgh and sent to the Edinburgh market, where it appeared to be unknown.” Couch¶, again, thought it one of the commonest fishes round the British Islands, though this refers chiefly to the southern shores, and that its spawning-season “is the early months of the year, although this is liable to variation, as, indeed, is the case with most fishes, so that in the cold season of 1837 the spawning of hakes was not accomplished until August.” Day adds nothing to the knowledge of its spawning. Kingsley and Conn allude to the egg from the American coast and give a figure. M'Intosh and Masterman\*\* observe “that Dr. Raffaele, at Naples, “mentions that ripe specimens occur in January,” and they appear to continue till May††. “In British waters the spawning-period seems to extend from January to July inclusive, Mr. Cunningham having found one perfectly ripe

\* Mörch, Proc. Zool. Soc. 1911, part iii. p. 663.

† *Ibid.* 1886, pp. 209–251.

‡ *Ibid.* 1910, p. 783.

§ *Ibid.* 1911, p. 424.

|| ‘Fishes of the Forth,’ p. 351 (1837).

¶ ‘Fishes of the Brit. Islands,’ vol. iii. pp. 99 & 100.

\*\* ‘British Marine Food-Fishes,’ p. 274 (1897).

†† ‘Le uovo galleggianti, &c.’ p. 37 (1888), Taf. 1. figs. 28, 29, and Taf. 3. fig. 1 (larva).

on July 6th at Plymouth, "while Mr. Holt procured another with nearly ripe ovaries at the end of June off the west of Ireland." Prof. Herdman, again, found spawning hake south of the Isle of Man on April 5th. In Scandinavia the spawning-season is in the middle of July, though the authors appear to attach weight to the statement of the fishermen that there is only a single small bank of sand and shingle in the Cattegat where the hake spawns\*.

Raffaele described the newly hatched larva and Mr. Holt the young from  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inches, whilst, lately, an able Danish observer, Dr. Johs Schmidt†, from his unique opportunities in the Danish research steamer 'Thor,' has been able to fill in the post-larval stages from  $4\frac{1}{4}$  mm., and the young to 31 mm., and thus complete the life-history. Amongst the marked features distinguishing the post-larval hake between 7 and 15 mm. are the plump form of the body, the occurrence of three post-anal pigment bars, the last only on the tail itself and not on the caudal fin, and the less elongated pelvic fins—when contrasted with the lings and torsk, while the older stages are marbled (Schmidt).

No spawning hake having been procured in the trawling expeditions of former years or since in Scottish waters, it was interesting that on the 4th July, 1911, a female hake 30 inches long was caught in the salmon stake-nets off the East Rocks, St. Andrews, the fish having apparently been swimming freely in the water. Its ovaries were well-developed and portions were ripe, the transparent eggs with a clear oil-globule readily issuing from the reproductive aperture and floating freely in a vessel of sea-water. The eggs measured about .8915 mm., and the oil-globules .2286 mm. These eggs are somewhat less than those described by Raffaele from southern examples. The hake would thus appear to agree with the cod in having its spawning-period prolonged over a week or two.

### 3. *On Eteone depressa*, *Mgrn.†, var., a Species not hitherto found in Britain.*

An *Eteone* collected at Scarborough by Dr. Irving and Mr. Arnold Watson during an excursion of the Yorkshire Naturalists' Union Marine Biology Committee appears to differ from any hitherto found in Britain, and I am indebted

\* 'Scand. Fishes,' Fries, Ekström, and Sundevall, 2nd edit. (Smitt), 1893, pp. 518 & 519.

† 'Meddelelser fra Kommiss. Havunders,' Kiöbenhavn, 1907, Serie Fiskeri, Bd. ii. pp. 4-7, pl. v. figs. 1-13.

‡ Nordiska Hafs-Annul. p. 103, tab. xv. f. 36; Annul. Polych. p. 149.

to Mr. Arnold Watson for the opportunity of describing it and for his notes and sketches of it when alive.

The annelid was found between tide-marks, and when alive was whitish or cream-coloured, but in sea-water with  $2\frac{1}{2}$  per cent. of formalin it passed through lemon-yellow to a dark brown, the tints being darker in some parts than in others, whilst a few points remained cream-coloured.

The head (Pl. V. fig. 1) is somewhat conical, with a smoothly rounded anterior border, from the sides of which spring the four subulate tentacles which taper distally and are nearly equal in length. Behind these the snout is constricted, then gradually widens till near the posterior border, when a slight constriction again occurs, thus giving a characteristic outline to the prostomium, the posterior border of which is carried backward in the middle line. Just in front of the central point is a minute boss, the presence of which at once attracted Mr. Watson's attention, and which, though in a different position, simulates the unpaired tentacle of *Eulalia*. On each side and a little in front of the boss is a comparatively small eye, quite distinct at first, but which gradually faded in the preservative fluid, as, indeed, happens to other species of the genus. The peristomium bears two tentacular cirri of similar shape to the tentacles and scarcely longer.

The body is about  $3\frac{1}{4}$  inches long and about  $\frac{1}{13}$  of an inch wide (Watson) in life, and it is flattened both dorsally and ventrally, the latter surface being distinguished by a broad median depressed band and a short lateral area in each segment. On the dorsum, again, a similar effect is produced by the slight elevations at the outer border of each segment, though the median section is slightly convex and of the colour formerly mentioned. It tapers a little toward the snout, and much more gradually toward the tail, which ends in two lobate or spatulate cirri (Pl. V. fig. 2). The segments throughout are well-marked, and in the preservative fluid ( $2\frac{1}{2}$  per cent. formalin in sea-water and then alcohol) a curious increase of the pigment has occurred, with pale segment-junctions. The dorsal and the ventral cirri are dark like the ventral surface, but the setigerous processes remain pale; such of course, though interesting, is the effect of the preservative fluid, and must not be confounded with its original pallor.

The feet form an even series along each side, the typical foot (Pl. V. fig. 3) having dorsally an ovate-rotundate lamella, which varies a little in the posterior region—that is, becomes more elongate and therefore more conical. The



cirrophore supporting it anteriorly is short and broad, the base of the cirrus being constricted in the posterior segments as it approaches it, whereas in the anterior segments the low broad cone formed by the cirrus shows this less prominently. The distal extremity forms a blunt cone. This cirrus, as in one or two other species of the genus, is proportionally large in a lateral view of the foot, its cirrophore occupying about half the vertical diameter of the foot, and it extends distally much beyond the other divisions. The setigerous process is bluntly conical, the tip being double, with a bite in the middle, and the bristle-tuft is supported by a pale spine, the tip of which does not project beyond the surface, though it almost touches it. The bristles (Pl. V. figs. 4 & 5) are translucent, with a distal curvature of the shaft, and form a broad fan anteriorly, with the convexity of the shaft directed upward. The terminal piece is perhaps slightly longer than in *Eteone picta*, and forms a translucent tapering serrated blade. The shaft is dilated at its termination above the curvature, and carries a long tapering spur, the point of which curves toward the serrated or upper border of the terminal blade; and on the same side (that is, with the serrated edge of the blade to the left) is a shorter spur and a series of diminishing serrations on the free edge below it. The bristle thus differs from that of *Eteone picta*, especially in the proportionally longer hook at the end of the shaft and the more coarsely spinous edge below the base of the larger process. In *E. picta* the large hook is shorter, stronger, and more boldly curved, and the lateral hook smaller. In *E. arctica* the great hook is likewise shorter and stouter. In *E. lentigera* the comparatively small though stout main hook is only a little larger than the secondary. In *E. spetsbergensis* the secondary hook is long and sharp and runs parallel to the larger hook, which is more or less straight. In the posterior region of the body both spines are well developed, and some have a tendency to curve at the tip. In *E. pusilla* the disproportion between the two hooks or spines is great, the smaller, however, being slender and sharp. In some small spines abut on the larger toward the dorsal edge of the terminal blade—that is, the side opposite the serrated edge. The blade, moreover, is perhaps more distinctly bellied inferiorly.

The ventral cirrus anteriorly has the shape of a truncated cone, the tip of which projects beyond the setigerous lobe. In the posterior third this cirrus diminishes in bulk and its tip is nearly in a line with the setigerous process, its ventral outline presenting a swelling or hump, apparently an indica-

tion of its approach to the fused cirrophore. Toward the tip of the tail, again, both the setigerous lobe and the ventral cirrus have diminished in bulk, the latter especially being longer and more slender, and its tip often projects beyond that of the setigerous lobe, the bristles in which are fewer and shorter.

This form generally resembles *Eteone depressa*, Malmgren, and especially in the structure of the feet and bristles, but it differs in the presence of the "boss" or rudimentary tentacle at the posterior border of the prostomium. If the various authors who have examined it, however, had only seen spirit-preparations, it is possible that it may have been overlooked. Hitherto it has been found, amongst other places, at Bellsund, Spitzbergen, Greenland, Nova Zembla, and the Murman Sea. In his brief note on the species Théel\* states that the head differs from Malmgren's outline, and he gives a corrected figure. Fauvel†, another able investigator of the Annelids, considers that this species may be identical with *Etione spetsbergensis*, Malmgren, but, as indicated in the preceding remarks, there are reasons for keeping them separate.

#### 4. *On Nereis zonata*, Mgrn., in Britain.

*Nereis zonata*, Malmgren, is a form which, though not uncommon in northern waters, as in the cruise of the 'Valorous,' appears to be rare in Britain.

Malmgren received it from Greenland and Spitzbergen. and Marenzeller and others from North European and North Asiatic regions. The head resembles that of *Nereis pelagica* in regard to general shape, but the eyes are somewhat larger and the tentacles and tentacular cirri are longer and more slender. A dark band of pigment runs in the line of the eyes, and a band of white passes forward between them. The body has a distinctive coloration, viz. a pale reddish-brown hue in spirit, though Malmgren adds yellowish or bluish to the reddish brown. The arctic examples from the 'Valorous' were distinctly banded transversely, a feature very evident in young specimens. It is terminated posteriorly by slightly longer cirri than in *N. pelagica*, though much reliance need not be put on this feature. The maxillæ of the proboscis have the same number of teeth, those of *N. pelagica* perhaps being usually more distinct, and the tip,

\* Annél. N. Zemble, p. 32, pl. ii. figs. 19 & 20.

† Annél. Campagne Arctique de 1907 (Duc D'Orleans), p. 27, pl. i. fig. 6 (1911).

if anything, is more slender. The paragnathi generally are finer than in *N. pelagica*, and I. is absent in the present examples and in those procured by the 'Valorous' in Greenland, and at most is represented by a single horny point, as in Marenzeller's specimens. The groups in II. are somewhat smaller individually, and apparently less numerous than in *N. pelagica*. III. forms a longer transverse band of more minute denticles, and group IV. is composed of more acute paragnathi in a double curve, the inner formed of smaller denticles. V. is absent, as in *N. pelagica*, and VI. forms a group of smaller denticles than in *N. pelagica* on the elevations at each side. This group is very variable in *N. pelagica*, occasionally only a single large denticle being present on each side, and in all cases the paragnathi are larger. VII. and VIII. form the basal row in extrusion, and no groups differ from the homologous parts in *N. pelagica* more than these. VII. shows the two largest paragnathi in the series constituting a basal band in extrusion, and which (band) differs from that of *N. pelagica* in the isolation of the larger distal and the minuteness of the proximal denticles. In *N. pelagica* the large distal paragnathi are much more numerous and less regularly arranged, and the proximal smaller denticles are likewise in greater numbers. Side by side the contrast between the two is noteworthy.

In glancing along the feet of the two forms the rounded and blunt condition of the tips of the processes in *N. pelagica* distinguish it, for in *N. zonata* the lobes are much more acute, and Malmgren's figures originally indicated this clearly. The examples were procured in Lambay Deep, Irish Sea, and I have to thank Mr. Southern for the opportunity of examining them.

*Nereis zonata*, Malmgren, var. *persica*, Fauvel, occurs in the Persian Gulf, and has lately been carefully described by Prof. Fauvel\* both in the ordinary and epitokous conditions. The author also states that he considers *Nereis procera* of Ehlers to be the same species, and so with *Nereis pulsatoria* of Grube. He concludes that *Heteronereis grandifolia* ♀, Malmgren (*Heteronereis assimilis*, Rathke), is the epitokous condition of *Nereis zonata*. *N. zonata* appears to have a very wide distribution both off the Atlantic and Pacific shores.

The epitokous forms of *Nereis pelagica* are distinguished from those of *N. zonata* by the coloration, the latter having

\* Archiv. Zool. Expér. vol. xlv. p. 382, pls. xix. & xx. (April 1911).

light transverse bands which are not present in the former, and the paragnathi of groups I. and VI. In *N. pelagica* the lobes of the feet are evenly rounded, whilst in *N. zonata* they are triangular and run out to a broad point. Ditlevsen \*, who has recently written on the subject, further notes that in *N. pelagica* the short terminal processes of the bristles are shorter and more curved than in *N. zonata*. The author disagrees with Michaelsen's view that *Heteronereis arctica* of Örsted is the female epitokous form of *N. zonata*, and therefore thinks that the title *N. zonata* should stand. Moreover, whilst *N. pelagica* is generally a littoral species, *N. zonata* is procured by the dredge.

### 5. On the British Capitellidæ (Hæleminthidæ).

No notice of these occurs under the "Annelides" of Dr. Johnston's 'Catalogue of Worms in the British Museum,' but, following *Clitellio* in the Order Scoloces, under the littoral family of the Tribe Lumbricina, is a species termed *Valla ciliata*, which refers to *Capitella capitata*, and, indeed, the author in a footnote states that De Quatrefages would place the genus probably amongst the Ariciidæ in the errant Annelids. In this arrangement Dr. Johnston probably followed Grube in his 'Familien der Anneliden' (1851). De Quatrefages, again (1865), placed the Capitellidæ between the Maldanidæ (his Clyméniens) and the Arenicolidæ—as a group of uncertain position; his three chief genera being *Capitella*, *Notomastus*, and *Dasybranchus*. Without going further into detail, the monumental work of Dr. Hugo Eisig, published in 1887, cleared up all ambiguities, and placed the group on a satisfactory basis in respect to structure, physiology, systematic position, and distribution. In text as well as in plates the high standard of this treatise is an honour to the Zoological Station of Naples and to the author.

Only three species of this family—viz., *Notomastus latericeus*, Sars, *Capitella capitata*, Fabr., and *Dasybranchus*—occur in Britain. The former (*Notomastus latericeus*) is widely distributed from Shetland to the Channel Islands, whilst abroad it is almost cosmopolitan. Its bright red colour makes it a conspicuous feature on the West Sands at St. Andrews after storms, and it is by no means a minute form, for it ranges from 6–10 inches in length. The head consists of two rings and is conical and sharp-pointed,

\* 'Danmark-Eksped. Grönlands,' 1906–8, Bd. v. p. 419, pl. xxviii. fig. 6, pl. xxx. figs. 18 & 22 (1912).



and it can be retracted so as to leave only the margin of the buccal segment in front. At its base on each side are two groups of brownish grains marking the nuchal organs. The second or buccal segment is biannulate, devoid of bristles, and the mouth opens on its ventral surface as a proportionally large aperture. The body is a little tapered in front of the larger anterior region, remaining of nearly equal diameter for a considerable distance, and then tapering gradually to the tail, which ends in a slightly upturned vent with two papillæ beneath.

The anterior region comprehends the buccal and eleven bristled segments, each of which is two-ringed and more or less tessellated on the surface. The succeeding region differs in appearance, having, as a rule, longer segments with prominent tori for the hooks. Each segment anteriorly shows a double median dorsal elevation and two long lateral ridges which pass to the ventral surface. Posteriorly, again, the four tori are more nearly equal in size and more widely separated, two being dorsal and two ventro-lateral in position, the two median elevations of the dorsum having disappeared; and toward the tip of the tail the four prominent tori give the body a quadrangular aspect on section. The anterior segments have a deep transverse furrow which divides them into two halves. Laterally this furrow bends backward at each bristle-tuft—making, as it were, a small setigerous process,—the bristles issuing quite at its posterior border. The two upper tufts of bristles are wholly dorsal, and thus those of opposite sides approach each other more nearly than the ventral. The bristles have simple straight shafts, which begin to taper at the slight bend marking the commencement of the somewhat narrow wing. Though the tip is acute yet the whole bristle is elastic and strong. De St. Joseph states that their bases rest on a large gland.

At the twelfth bristled segment a double process carrying hooks appears in the mid-dorsal line, and this continues to the twentieth segment of the region without much change. Thereafter the two processes have a tendency to disappear, so that at the thirtieth segment no trace occurs, the arrangement resolving itself posteriorly into a dorsal and a ventral pair of tori, the former rounded and short, the latter more elongated. The tori of this (second) region are furnished with minute elongated hooks, having a slender shaft narrowed at its commencement and again toward the neck, the tip ending in a sharp main fang, whilst, in lateral view, the crown has two spikes above it.

The differences in the muscular and other tissues of the anterior and posterior regions sufficiently explain the fact that, as a rule, only the anterior region is tossed on shore by storms.

In the first segment of the second region, and in the following six to eleven, are the openings for the issue of the genital elements on papillæ on the ventral surface.

The second species, *Capitella capitata*, Fabr., has a similar distribution round the British shores to the foregoing, and is likewise almost cosmopolitan. Its length is from 3-5 inches, and the anterior region has nine or ten segments. The head is an elongated cone with two minute lateral papillæ (nuchal organs). The mouth opens as a puckered orifice on the ventral surface of the peristomial segment. The body increases in breadth from the snout backward to the sixth or seventh, and then slightly diminishes to the fourteenth, behind which the body is somewhat narrower, though this distinction is often obliterated. It diminishes posteriorly and ends in a button-shaped process often with a dimple in the centre; but reproduction of this region is so common that it is seldom a complete example is procured. The body is rounded anteriorly, and when preserved has a tendency to a quadrangular condition posteriorly, the ventral surface being flattened and generally grooved anteriorly, the groove in the larger examples being specially marked at the eighth and ninth segments. On the lateral region of the body at the junction of the seventh bristled segment with that following in the female is a vertically elongated papilla with a deep fissure (genital opening) in its centre. On the ventral surface of the ninth bristled segment is the depression at the end of the furrow leading into the aperture.

The copulatory apparatus in the male (ninth and tenth segments) has four bundles of strong spines—a pair to each segment. About the middle of the ninth segment, and apparently immediately in front of the papilla, is the anterior series of ten spines, five on each side, the outer being the smaller. The concavity of the curve of each spine, like the point of the hook at its tip, is directed outward and backward, the convexity looking toward the convexity of the adjoining series. A space occurs between them and the posterior pair, the points of which are directed forward, and just appear, under pressure, at the edge of the ciliated sexual aperture. These spines are four in number, the two inner being larger than the outer, and they are directed forward and inward.

The anterior region (behind the peristomium) consists of

seven segments, each almost symmetrically divided by four rows of golden bristles with a double curve and winged tips. At the ninth segment hooks take the place of the bristles, and the winged forms have two minute spines above the main fang in lateral view, and this arrangement continues to the posterior end, though the caudal hooks are smaller.

Fragments apparently of the anterior third of a form near *Dasybranchus* were dredged by Dr. Gwyn Jeffreys in 80–100 fathoms in muddy sand in St. Magnus Bay, Shetland, in 1867. In what seems to be an anterior fragment the ventral ridges for the hooks extend round the edges of the flattened body to the dorsal surface, where they cease. No hooks could be found dorsally, and therein it differs from *Dasybranchus*. The dorsal surface is rounded and lobed, and the walls are so attenuate that in certain fragments the muddy contents and the orange hue of the gut-wall shine through. The ventral surface possesses thick walls and is flattened in front, with a median ridge, which is absent from the posterior fragments, which are only ridged transversely. The hooks are minute, have a very short main fang with two teeth above it (in lateral view). The ventral longitudinal muscles are greatly developed.

#### 6. On the Capitellidæ procured by H.M.S. 'Porcupine.'

*Dasybranchus caducus*, Grube? Dredged in the 'Porcupine' Expedition of 1870, in the Bay of Tunis. Some of the fragments are about 4 inches in length and 6–8 mm. in diameter. It is distinctly tapered anteriorly, gradually enlarges toward the middle, and again probably tapers posteriorly, but as the specimen is incomplete this is conjectural.

The head forms a short, blunt cone, which, in the preparation, is partly withdrawn into the peristomial segment, which is marked dorsally by a somewhat regular series of longitudinal striæ over an eminence. Ventrally the proboscis is extruded as a short cylinder with a corrugated and slightly glistening surface. In the preparation the peristomial segment forms a blunt cone, and, besides the eminence, a differentiation of the longitudinal striæ a little in front of the middle dorsally and the presence of a transverse depression may indicate a sensory organ. Whilst this segment is undivided ventrally, a deep furrow dorsally cuts off a posterior belt. Such may be an indication of the arrangement of the succeeding rings. The segment following

the foregoing has the type of the thirteen which constitute the region, viz. is two-ringed, the middle sulcus having a broad papilla on each side dorsally directed backward, and bearing a tuft of bristles (Pl. V. fig. 8), which have a long, slightly curved shaft ending in a finely tapered tip with wings.

The hooks occupy a ventro-lateral position not far removed from the dorsal arch, and thus in a ventral view they escape notice. They occupy a similar position with regard to the median sulcus of the segment, viz. project on a flattened papilla or process behind it. Each hook (Pl. V. fig. 9) has a slightly curved shaft tapered a little inferiorly, gradually enlarging to the commencement of the wing, then narrowing to the throat, from which the main fang comes off at a little more than a right angle, and with two teeth on the crown above. The wings are fairly broad, and are rounded distally beyond the fang.

Behind the last bristle-bundle a change in the segments is inaugurated, for whilst they remain 2-ringed the dorsal papilla for the bristles disappears, and a lateral groove is gradually formed dorsally a little below the line of the bristles, this groove being rendered more distinct by a prominent papilla which marks the second ring of the segment laterally, and indicates the line of hooks below it. The mid-ventral line now presents a groove which continues for fully an inch backward. Instead of the bristles dorsally a line of hooks—indicated at first by a slight inflection of the median groove of the segment—takes their place. Ventrally a long band of hooks is present on each side, and by-and-by meet in the middle line, so that this region of the body is mainly concerned with movements in the tunnel in the mud or sand.

About the sixtieth armed segment the rows of hooks have arranged themselves on a long pad on each side dorsally, separated in the middle line by a considerable interval; whilst on the ventral surface the rows appear to meet in the middle line, so that a continuous series stretches from side to side, a slight inflection of the line in front and behind in the centre indicating the seat of separation in front.

Behind the foregoing region (sixtieth foot) the body in the preparation undergoes considerable dilatation dorsally, and the ventral line of hooks ends on each side laterally in a pale elevated ridge which terminates abruptly superiorly, a pale striated region occurring between it and the commencement of the dorsal rows, which are still separated by a considerable interval. They are recognized by the opaque elevation in front and behind.



Moreover, in every segment in the more posterior region an aperture exists about the upper end of the ventral row of hooks, and out of this a small branchia projects. Some are included until pressure is made on the body, and then they are distinct. These apertures are at a higher level, for instance, than those of the 'Challenger' form, Station 233 B, which are at each edge of the flattened ventral surface and have an elongated glandular fillet above them. The position of the branchiæ thus corresponds with the description and figure of Claparède\* from specimens procured at Port Vendres.

In the intestine of the middle region are many ovoid masses of mud as in *Chaetopterus*. These consisted for the most part of very fine amorphous mud of a pale brown colour, with a few sand-particles, a few minute fragments of sponge-spicules, but very few traces of softer tissue.

The specimen appeared to be a female with small ova in the perivisceral cavity.

In an example from Concarneau, De St. Joseph † found the branchiæ covered with *Rhabdostyla arenicolæ*, Fabre Domergue.

A fragment of the middle region of what appears to be a *Dasybranchus* was dredged in the 'Porcupine' Expedition of 1870, off Cape Sagres, in 45 fathoms. The hooks agree with those of *D. caducus*.

## EXPLANATION OF THE PLATES.

### PLATE IV.

Photograph of the white porpoise by A. W. Brown.

### PLATE V.†

- Fig. 1.* Enlarged view of the head and anterior region of *Eteone depressa*, Malmgren, from the dorsum.  
*Fig. 2.* Similar view of the tip of the tail after preservation, supplemented by a sketch by Mr. Arnold Watson.  
*Fig. 3.* Lateral view of a foot from the anterior third of the body. × about 60 diam.  
*Fig. 4.* Bristle of the same species after preservation. × Zeiss oc. 2, obj. F.  
*Fig. 5.* Another bristle turned so as to show the serrations at the tip of the shaft. × Zeiss oc. 4, obj. C.

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\* Glanures Zoot. p. 56, pl. viii. fig. 8.

† Ann. Sc. Nat. 8<sup>e</sup> sér. v. p. 391.

‡ I have to thank the Carnegie Trust for artistic aid with this Plate.

*Fig. 6.* Head and anterior region of *Dasybranchus caducus*, Grube, the prostomium being withdrawn. Enlarged under a lens.

*Fig. 7.* Segments from the middle of the body of the foregoing showing the branchiae. Similarly enlarged.

*Fig. 8.* Bristle from the anterior region of the same.  $\times$  Zeiss oc. 2, obj. D.

*Fig. 9.* Hook of the foregoing.  $\times$  Zeiss oc. 4, obj. F.

## XII.—A new Elephant Shrew from the Island of Zanzibar.

By GUY DOLLMAN.

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### *Rhynchocyon adersi*, sp. n.

Closely allied to *Rhynchocyon petersi*, Boc., but considerably darker in colour, especially on the anterior part of the body.

Size of body much as in *petersi*. General colour of upper surface conspicuously different from that of *petersi*; snout rufous, the colour deepening on the sides of the face and forehead to a maroon tint. Crest on head deep chocolate-maroon, this colour extending back down the mid line to join with the black of the hind-quarters; shoulders and anterior portion of flanks dark maroon. Hind-quarters and posterior back deep black, the black wash extending considerably further forwards on the flanks than in *petersi*, giving the whole animal a much darker and more sombre appearance. Backs of hands and feet rufous orange; metatarsal area tinted with dark brownish black. Ventral surface of body darker than in *petersi*, the general rufous tint deeper and less orange. Tail similar in length but with a much shorter white area at the tip, measuring only some 48 mm. in length, while in the type specimen of *petersi* this white area is fully 60 mm. long. General colour of dorsal surface of tail rufous orange, considerably darker than in *petersi* and without such a well-marked dark dorsal line on the basal portion.

Skull like that of *petersi* in general form.

Dimensions of the type (measured from dry skin):—

Head and body 300 mm.; tail 240; hind foot 72\*; ear 26.

Skull: greatest length 69; basal length 59; zygomatic breadth 36.6; palatal length 35.5; width of palate (inside *m*<sup>1</sup>) 12.2; length of maxillary tooth-row, from front of first premolar to back of last molar, 23.2.

\* Approximate.

*Hab.* Island of Zanzibar.

*Type.* Old male. B.M. no. 12.1.6.1. Collected and presented to the British Museum by Mr. W. M. Aders.

In addition to the type Mr. Aders sent home another individual of this interesting insectivore, quite similar in colour and general proportions.

Through the kindness of Dr. A. F. de Seabra, of the Museu Bocage, I have been able to compare these Zanzibar individuals with the type specimen of Bocage's *petersi*. It was at once apparent that the true *petersi* agreed, not with the island specimens, but with those from the mainland; and examination of the label and history of the specimen showed that it originally came from East Africa, Zanzibar being used in the original description for the whole district and not for the island. It thus becomes necessary to give a name to the island species, which I am pleased to call after the collector and donor, Mr. Aders.

### XIII.—On a new Palm-Civet from Timor.

By ERNST SCHWARZ.

THIS new *Paradoxurus* is closely allied to *P. hermaphroditus sumbanus*, which is connected by it with the other Malay representatives of the genus. I have named it in honour of its discoverer, Mr. C. B. Haniel,

#### *Paradoxurus hermaphroditus hanieli*, subsp. n.

Nearly allied to *P. hermaphroditus sumbanus*, but distinguished from it by its superior size, shorter and softer fur, and different colour.

Fur moderately long, very rich and soft,

*Colour* (of type). Back light olive-brown, with a distinct black line down the middle of the back, and on each side of it a row of black spots. (Hairs of back brownish grey at base, then strawy yellow with black tip.) Crown, ears, muzzle, cheeks, limbs, and tail, except its basal fourth, black. Nape strongly suffused with grey, markedly contrasted with the colour of the back; sides of neck with a strong suffusion of creamy buff. Face-markings exactly as in *P. h. sumbanus*. Shoulders and thighs indistinctly spotted. Underside of body brownish buff.

In some specimens the hairs of the back have a more pale or more golden-yellow subterminal band, thus producing a

more greyish or a more golden-yellow general effect. The dorsal lines tend to disappear in some individuals.

*Skull* much as in *P. h. sumbanus* but much larger. Zygomatic arches very wide and intertemporal constriction well-marked, but short as in that form. Nasals U-shaped, very broad. Bullæ small, much smaller than in *sumbanus*, inflated between carotic canal and *foramen lucerum posterius*. Sagittal crest in males very high.

*Teeth* similar to those of *P. h. sumbanus* but a little larger.  $P_4$  with a well-developed anterior tubercle (parastyle) and narrow postero-internal ledge.

*Type*. Zoological Museum, Munich; original no. 90; skin and skeleton of old male. Collected by C. B. Haniel on August 5th, 1911.

*Type locality*. Baung, Amarassie, Timor.

*Specimens examined*. Ten from various localities: Ofu, Baung, Noimina; all in Timor.

*Dimensions of the type* (taken on the flat skin):—

Head and body 590 mm.; tail (without hairs) 450.

*Skull*: basilar length 96; condylo-basilar length 100; greatest breadth 65·3; mastoid breadth 37; nasals  $24 \times 11\cdot2$ ; intertemporal constriction 12·1; width of brain-case 37·5; palatilar length 44; palate, greatest breadth (including teeth) 37; least breadth (between canines and incisors) 11; breadth of rostrum across roots of canines 20·5; foramina incisiva 5; front of  $p_1$  to back of  $m_2$  33;  $p_4$ , length on outer edge 8·4, breadth 7, greatest diameter 9·7.

The Timor Palm-Civet is readily distinguished by the greyish hue on the neck and the black head. From *P. h. sumbanus* it differs in the characters indicated above; *P. h. setosus* of Ceram is larger, more yellowish in coloration, and has much larger bullæ and more complex teeth.

#### XIV.—On a Terrestrial Amphipod from Kew Gardens.

By W. T. CALMAN, D.Sc.

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SPECIMENS of the Amphipod described below have been sent to the Natural History Museum by Mr. A. W. Hill, Assistant Director of the Royal Botanic Gardens, Kew. They were found in the "Tropical Pits," and about a dozen specimens, including adults of both sexes, have been collected at various times.



Terrestrial species of Amphipoda belonging to the family Talitridæ are known from various parts of the world, and have been found in hothouses in Europe, but not hitherto, so far as I know, in this country.

Since the reference of the species to the genus *Talitrus* depends upon the characters of the males, it may be worth while to note that the sex of these was definitely ascertained by observation of the genital papillæ on the last thoracic somite.

*Talitrus hortulanus*, sp. n.

*Adult male*.—Total length 8 mm.

Length of *head* along dorsal edge less than that of first two free somites together. First *coxal plate* rather broadly rounded below; fifth more than half as long again as fourth, its anterior lobe truncated below. First three abdominal *pleural plates* with posterior corners pointed and slightly produced. *Eyes* round, of moderate size.

*Antennules* extending well beyond middle of last segment of antennal peduncle; first three segments increasing successively in length; flagellum of seven or eight segments besides a minute terminal one.

*Antennæ*: peduncle equal or nearly so to the length of head and first two free somites together; flagellum half as long again.

*Maxillipeds*: outer plates with distal edge directed obliquely inwards and broadly rounded (not bluntly pointed as in *T. sylvaticus*); palp with a minute fourth segment, obscurely defined.

*First gnathopods*: carpus about  $2\frac{1}{2}$  times as long as wide and  $\frac{1}{3}$  longer than propodus; propodus more than three times as long as wide, hardly narrowed distally,  $2\frac{1}{2}$  times as long as dactylus.

*Second gnathopods* very long and slender; basis distinctly shorter than three following segments together; merus with lower margin evenly rounded, without projecting lobe or area of shagreened cuticle; carpus nearly twice as long as merus, five times as long as its width in the middle, with a small shagreened lobe close to distal end of lower edge; propodus a little longer than carpus, about five times as long as wide, with articulation of dactylus at about one-fifth of its length from distal end.

*Percæopods* of first and second pairs subequal in length; third pair a little longer than second, basis ovate, with hind margin gently convex; fifth pair longer than fourth, basis

nearly as broad as long, hind margin with low and widely spaced serrations.

*Pleopods*: all three pairs biramous, with the rami not distinctly segmented. Peduncle of the first pair about six times as long as broad, with a pair of coupling-spines on inner edge; exopod half as long as the peduncle, endopod a little more, each bearing a few feathered setæ. Peduncle of second pair as long as that of the first, but much stouter, its width about one-fourth of its length, bearing a pair of coupling-spines; rami slightly shorter and stouter than those of first pair. Peduncle of third pair two-thirds as long as that of second and about three times as long as wide, with a single coupling-spine and setæ on outer and inner edges; rami short and broad, the endopod half as long as the peduncle, the exopod a little less.

*Uropods*: last pair more than half as long as telson, with a spine on each segment.

*Telson* curved dorsally, with an apical pair of long spines on either side of a short median fissure.

*Adult female*.—Total length 9.5 mm.

Hardly differing in general characters from the male; peduncle of antennæ slightly but distinctly more slender; second gnathopod with propodus slightly stouter, a little more than four times as long as wide.

One specimen carried six eggs in the brood-cavity.

*Remarks*.—Among the accepted species of the genus *Talitrus* (Stebbing, 'Tierreich,' Gammaridea, 1906, p. 524) the form here described will find its place, on account of the relative length of the antennules, near *T. sylvaticus*, Haswell (New South Wales, Victoria, and Tasmania), and *T. alluaudi*, Chevreux (Seychelles, Madagascar, and hothouses in France). From *T. sylvaticus*, as recently redescribed by Sayce (Proc. R. Soc. Victoria, xxii. 1909, p. 30), and as represented by two specimens in the British Museum, it is separated by the form of the basis of the third peræopod, which, in the species named, is characteristically narrowed below, with the hind margin straight or slightly concave. *T. alluaudi*, as described by Chevreux (Mém. Soc. zool. France, 1901, p. 389), has the telson remarkably large and spinous. The most important distinctive characters of the new form, however, are those of the second gnathopod, which in both the species named is much shorter and stouter, with the propodus not more than three times as long as wide, and with a projecting shagreened lobe on the under side of both merus and carpus. There are other characters, such as the relative length of the

antennæ and the form of the outer plates of the maxillipeds, which help to confirm the distinctness of the Kew species from both the others.

At the same time it should be noted that comparison of the earlier accounts of *Talitrus sylvaticus* gives the impression that this species is more than usually variable, or else that more than one species has been included under that name. Haswell's earlier figures (Proc. Linn. Soc. N.S.W. iv. 1879, pl. vii. fig. 1) show the second gnathopods as very slender, with the propodus four times as long as wide in the male. In the later figure by Haswell (*op. cit.* x. 1885, pl. x. fig. 1), as in those given by Thomson (Proc. R. Soc. Tasmania, 1892 (1893), pl. iv.) and by Sayce, the proportions are very different.

A still more puzzling discrepancy exists between published accounts of the pleopods. Thomson (*t. c.* p. 61) states that he failed to find any trace of the third pair. Sayce (*t. c.* p. 32) confirms this: "no vestige of a third pair is to be found." Chevreux (*t. c.* p. 392), on the other hand, describing specimens of *T. sylvaticus* sent to him by Prof. Chilton, states that the pleopods of the third pair \* resemble those of the first two pairs in being biramous, although they are of smaller size. In two specimens from Port Jackson, received from the Australian Museum many years ago as *T. sylvaticus*, I find the third pleopods to be represented by small vestiges much like those figured by Chevreux in the case of *T. alluaudi*. These vestiges are so small and, from their position, so hard to see, that they may possibly have been overlooked both by Thomson and by Sayce. It is hardly possible, however, that Chevreux can have been deceived on this point, to which he gave special attention in comparing the species with *T. alluaudi*.

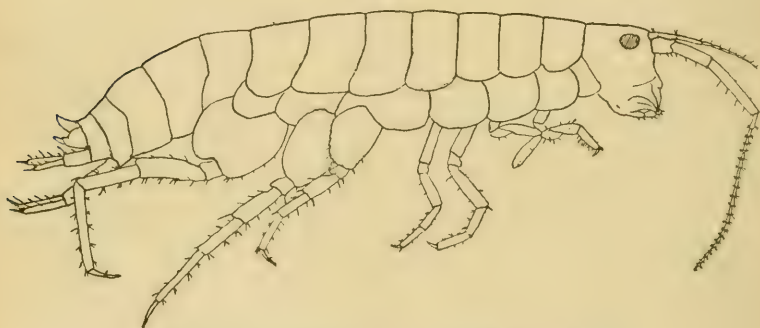
Mr. A. O. Walker, who has been good enough to examine specimens of the Kew *Talitrus* for me, has called my attention to the resemblance of its elongated second gnathopods to those figured by Spence Bate in *Talorchestia* (?) *africana* (Cat. Amphip. Brit. Mus. 1862, p. 15, pl. ii. fig. 6). The resemblance is considerable, and since the holotype is a female, it is quite possible that Bates's species really belongs to the genus *Talitrus*. Even in its present mutilated and fragile condition, however, the specimen shows some characters which forbid its association with the Kew species. The

\* M. Chevreux writes "uropodes de la troisième paire," but from the context it is quite clear that he is referring to the pleopods.

dorsal outline of the head is shorter than that of the first free somite; the anterior lobe of the fifth coxal plate is more rounded below; the basis of the last pair of legs has a different outline, with the hinder margin less convex and more strongly serrated; the outer plate of the maxillipeds is bluntly pointed and the terminal segment of the palp is larger and sharply defined; the merus of the second gnathopods has a prominent lobe on the under side, and the carpus is, at all events, much less slender than in the species here described.

The genus *Talitroides* was proposed by Bonnier (in Willem, Ann. Soc. ent. Belgique, xlii. 1898, p. 208) for an unnamed species found in a conservatory at Ghent. To this species Stebbing afterwards gave the name *T. bonnieri*

Fig. 1.



*Talitrus hortulanus*, sp. n. Adult male,  $\times 10$ .

(‘Tierreich,’ Gammaridea, 1906, p. 527). It has not, I think, been pointed out that Bonnier’s description contains nothing inconsistent with the supposition that he had before him specimens of *Talitrus alluaudi*.

So far as I know, the only other species of terrestrial Amphipod recorded as found living under artificial conditions in Europe is *Orchestia senni*, recently described by Menzel (Rev. suisse Zool. xix. 1911, p. 438, figs. 4–9) from the botanic garden at Basel. As only the female is described, the species may possibly be referable to *Talitrus*, and may even not differ very greatly from *T. alluaudi*; it is certainly distinct from the species described here.



Fig. 2.

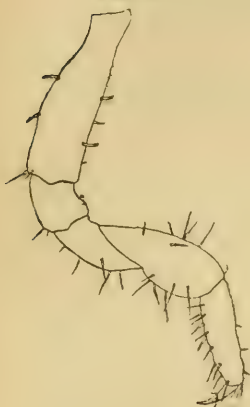


Fig. 3.

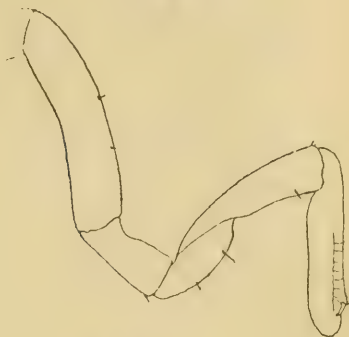


Fig. 5.



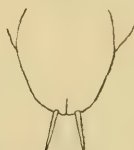
Fig. 4.



Fig. 6.



Fig. 7.



- Fig. 2.—*Talitrus hortulanus* ♂. First gnathopod.  
 Fig. 3.—Ditto. Second gnathopod.  
 Fig. 4.—Ditto. Basis of third peræopod.  
 Fig. 5.—Ditto. Fifth peræopod.  
 Fig. 6.—Ditto. Third uropod.  
 Fig. 7.—Ditto. Telson.

XV.—*Descriptions of Three new African Cichlid Fishes of the Genus Tilapia, preserved in the British Museum.* By G. A. BOULENGER, F.R.S.

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*Tilapia kafuensis.*

Depth of body  $2\frac{1}{4}$  times in total length, length of head 3 times. Head  $1\frac{2}{3}$  times as long as broad; snout rounded, with straight upper profile, slightly broader than long, a little shorter than postocular part of head; eye  $5\frac{1}{2}$  times in length of head,  $\frac{2}{3}$  interorbital width, a little less than præorbital depth; mouth rather large,  $\frac{4}{5}$  width of head, extending to between nostril and eye; teeth in 8 series, 110 in outer series of upper jaw; 4 series of scales on the cheek, width of scaly part a little greater than diameter of eye. Gill-rakers moderate, 25 on lower part of anterior arch. Dorsal XVII 13; last spine longest,  $\frac{2}{3}$  length of head; longest soft ray  $\frac{2}{3}$  length of head. Anal III 11; third spine not quite  $\frac{1}{3}$  length of head. Pectoral slightly longer than head, reaching vertical of origin of anal. Ventral reaching between vent and anal. Caudal rounded. Caudal peduncle as long as deep. Scales cycloid,  $33\frac{4\frac{1}{2}}{16}$ ; lateral lines  $\frac{22-23}{12-13}$ . Dark brown above, whitish beneath; a black opercular spot and three ill-defined black spots on the side below upper lateral line; soft dorsal and anal fins with round light spots between the rays.

Total length 360 mm.

A single specimen from the Kafue River, N.W. Rhodesia, presented by Mr. T. Codrington.

Distinguished from *T. mossambica* by the presence of four series of scales on the cheek and more numerous gill-rakers.

*Tilapia eduardiana.*

Depth of body equal to length of head,  $2\frac{1}{2}$  to  $2\frac{3}{4}$  times in total length. Head nearly twice as long as broad; snout rounded, with straight or convex upper profile, much broader than long ( $1\frac{1}{2}$  to  $1\frac{2}{3}$ ),  $\frac{1}{2}$  to  $\frac{3}{5}$  postocular part of head; eye  $3\frac{1}{2}$  to  $3\frac{2}{3}$  times in length of head,  $1\frac{1}{3}$  to  $1\frac{1}{2}$  times in interorbital width, much longer than præorbital depth; mouth moderate,  $\frac{2}{3}$  to  $\frac{2}{3}$  width of head, extending to between nostril and eye; teeth in 3 series, 66 to 88 in outer series of upper jaw; 2 or 3 series of scales on the cheek, width of scaly part  $\frac{1}{2}$  to  $\frac{2}{3}$  diameter of eye. Gill-rakers short, 20 to 23 on lower part

of anterior arch. Dorsal XVI-XVII 11-13; spines subequal from the fifth or sixth,  $\frac{2}{3}$  to not quite  $\frac{1}{2}$  length of head; longest soft rays  $\frac{1}{2}$  to  $\frac{2}{3}$  length of head. Anal III 9-10; third spine longer than longest dorsal,  $\frac{1}{2}$  or a little more than  $\frac{1}{2}$  length of head. Pectoral 1 to  $1\frac{1}{6}$  times as long as head, reaching beyond vertical of origin of anal. Ventral reaching vent or origin of anal. Caudal truncate. Caudal peduncle as long as deep. Scales 31-32  $\frac{31-4}{13-15}$ ; lateral lines  $\frac{20-22}{12-13}$ . Dark brown above, with or without very indistinct darker cross-bars, yellowish beneath; a black opercular spot; fins brown or blackish, uniform or with oblique streaks on the soft dorsal.

Total length 180 mm.

Several specimens from the south-eastern slope of Mt. Ruwenzori, altitude 3200 feet, collected by Mr. R. B. Woosnam on the Ruwenzori Expedition. I had first referred this fish to *Tilapia nilotica*, from which it differs in the longer caudal peduncle, the truncate caudal fin, and the longer anal spines.

### *Tilapia macrochir.*

Depth of body  $1\frac{3}{4}$  to  $2\frac{1}{5}$  times in total length, length of head 3 times. Head  $1\frac{2}{3}$  to  $1\frac{4}{5}$  times as long as broad; upper profile descending in a strong curve, often very abrupt in front; snout rounded, sometimes with concave upper profile, a little broader than long, shorter than postocular part of head; eye 4 to  $5\frac{1}{2}$  times in length of head,  $\frac{2}{3}$  to  $\frac{3}{5}$  inter-orbital width, equal to or a little less than præorbital depth; mouth rather small,  $\frac{1}{2}$  to  $\frac{2}{3}$  width of head, extending to between nostril and eye; teeth in 5 to 8 series, 70 to 100 in outer series of upper jaw; 2 or 3 series of scales on the cheek, width of scaly part not greater than diameter of eye. Gill-rakers moderate, 21 to 25 on lower part of anterior arch. Dorsal XVI (rarely XV) 12-13; last spine longest,  $\frac{1}{2}$  to  $\frac{2}{3}$  length of head; longest soft ray  $\frac{3}{4}$  to 1 length of head. Anal III 9-10; third spine  $\frac{1}{3}$  to  $\frac{1}{2}$  length of head. Pectoral  $1\frac{1}{3}$  to  $1\frac{1}{2}$  ( $1\frac{1}{4}$  in young) length of head, reaching beyond vertical of origin of anal. Ventral reaching vent or anal. Caudal truncate or slightly emarginate. Caudal peduncle deeper than long. Scales cycloid, 29-31  $\frac{3-3\frac{1}{2}}{13-15}$ ; lateral lines  $\frac{19-22}{11-14}$ . Olive-brown above, golden-yellow beneath, sometimes with rather indistinct darker longitudinal streaks following the series of scales; a blackish opercular spot; head and anterior part of body usually with small brown or blackish spots; young with 7 to 10 narrower vertical dark bars;

dorsal fin with more or less dark and light longitudinal streaks.

Total length 340 mm.

Several specimens from the Victoria Falls, Zambesi, presented by Mr. T. Codrington, and from Lake Bangwelu, presented by Mr. F. H. Melland.

Nearly allied to *T. andersonii*, Casteln.; distinguished by the longer pectoral fin.

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XVI.—*Descriptions of new African Batrachians preserved in the British Museum.* By G. A. BOULENGER, F.R.S.

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*Pyxicephalus macrotympanum.*

Vomerine teeth in two oblique series between the choanæ, close to the inner borders of the latter. Head feebly depressed, much broader than long; snout rounded, as long as the orbit; canthus rostralis obtuse, loreal region concave; nostril a little nearer the eye than the end of the snout; interorbital space nearly as broad as the upper eyelid; tympanum distinct, larger than the eye. Fingers extremely short, blunt, first and second equal; toes short, blunt, half webbed; sub-articular tubercles small; a large, compressed, very prominent but not sharp-edged inner metatarsal tubercle, its length equalling that of the inner toe. Tarso-metatarsal articulation reaching the tympanum; tibia two-fifths the length of head and body. Skin smooth. Pale greyish brown above, with dark brown dots, and a dark brown band extending from the end of the snout, through the nostril and eye, to the groin, where it breaks up into spots, and expanding into a large blotch below the eye and on the temple; a brown line borders the upper lip; lower lip with large brown blotches; lower parts white, with a few brown dots on the throat.

From snout to vent 55 mm.

A single female specimen from Gallaland, west of the Juba River, from the collection of Dr. Donaldson Smith. Had been referred to *Rana* (*Pyxicephalus*) *ornata*, Peters, in P. Z. S. 1895, p. 540; differs from that species in the broader head with more rounded snout and broader interorbital region, and in the larger tympanum.



*Phrynobatrachus francisci.*

Tongue with a conical papilla in the middle. Habit ranoid. Head moderate; snout short, rounded, projecting, without canthus; interorbital space as broad as the upper eyelid; tympanum feebly distinct, about half the diameter of the eye. First finger not extending quite so far as second; toes two-thirds webbed; tips of fingers and toes obtusely pointed; subarticular tubercles small; two small, rounded metatarsal tubercles and a small conical tubercle in the middle of the tarsus. Tibio-tarsal articulation reaching the end of the snout; tibia half the length of head and body. Head and back with small smooth warts and short glandular ridges, limbs and lower parts smooth. Brown above, with a dark brown band between the eyes, two pairs of large dark brown spots on the back, separated by an interrupted yellow vertebral line, and dark cross-bars on the limbs; white beneath.

From snout to vent 15 mm.

A single specimen from the Zaria Province of Northern Nigeria, presented by Mr. A. C. Francis.

*Hylambates verrucosus.*

Vomerine teeth in two oblique series between the choanæ. Head a little broader than long; snout rounded, as long as the diameter of the eye; canthus rostralis rounded; interorbital space as broad as the upper eyelid; tympanum distinct, half the diameter of the eye. Fingers moderate, free; toes barely one-fourth webbed; disks rather large, as large as the tympanum; inner metatarsal tubercle small, oval, not compressed. The tibio-tarsal articulation reaches between the shoulder and the eye; tibia two-fifths length of head and body. Skin with small smooth warts above, granulate on the belly and under the thighs. Dark purplish brown above and beneath; axil and groin with a large orange spot; thighs and lower surface of tibia and tarsus barred black and orange.

From snout to vent 58 mm.

A single female specimen from the Mabira Forest, Chagwe, Uganda, presented by Dr. C. Christy.

*Hylambates christyi.*

Vomerine teeth in two small groups just behind the level of the choanæ. Head much broader than long; snout rounded, as long as the diameter of the eye; canthus rostralis

obtuse; interorbital space as broad as the upper eyelid; tympanum distinct, three-fourths the diameter of the eye. Fingers rather short, with a rudiment of web; toes half webbed; disks rather large, but much smaller than the tympanum; inner metatarsal tubercle large, compressed, about two-thirds the length of the inner toe. The tibio-tarsal articulation reaches the eye; tibia nearly half length of head and body. Skin smooth above; a fine glandular fold running from the eye downwards to the middle of the side. Purplish brown above, with rather indistinct dark cross-bands on the limbs; glandular lateral fold and a transverse line above the vent yellowish, dark-edged beneath; two or three dark brown ocellar spots edged with yellowish on the lumbar region; lower parts white.

From snout to vent 53 mm.

A single female specimen from the Mabira Forest, Chagwe, Uganda, presented by Dr. C. Christy.

## XVII.—*A Revision of the Asilidæ of Australasia.*

By GERTRUDE RICARDO.

[Continued from vol. ix, p. 594.]

### DEROMYIA, Philippi.

Verh. zool.-bot. Ges. Wien, xv. p. 705 (1865).

*Diogmites*, Loew, Berlin. ent. Zeitschr. x. p. 21 nota (1866).

This genus has been as yet confined to the American continent, but the species described below appears to belong to the genus, which is distinguished by the closed fourth posterior cell of wing before it reaches the margin, by the absence of a style to antennæ, by the comparatively long first two joints of antennæ, and by the wide head. The face has no tubercle and the moustache is almost confined to the oral opening. My new genus *Neosaropogon* is distinguished from it by the fourth posterior cell of wing being open or only narrower at border.

### *Deromyia australis*, sp. n.

Type (♀) and two other females from Stannary Hills, N. Queensland, *circa* 3000 feet (*Dr. T. L. Bancroft*), 1909.

An *Asilus*-looking species, with hyaline wings, blackish abdomen, reddish-yellow antennæ and legs.

Length of type 18 mm., others 16 mm.

*Head wider than thorax.*

*Face* covered with pale golden tomentum, flat, raised at oral opening almost as a tubercle, on which the pale yellow bristles forming the moustache are placed. *Palpi* reddish yellow, with long pale yellow hairs. *Proboscis* long. *Beard* white. *Antennæ* reddish yellow: the first two joints with thick black hairs; the second slightly the longest; the third club-shaped, hardly longer than the first two joints together. *Forehead* darker than face, with six long black bristles on the ocelligerous tubercle. *Hind part of head* with bristle-like yellow hairs. *Thorax* greenish grey, with greyish-yellow tomentum, with three black bristles above the transverse suture at sides and numerous ones beyond; breast-sides paler in colour; prothorax well developed; *scutellum* armed with two black bristles. *Abdomen* blackish, with narrow dull reddish posterior borders to segments; sides of dorsum yellowish, grey tomentum on anterior borders and at sides of segments; pubescence very scanty, short, yellowish; ovipositor prominent below.

*Legs* reddish yellow; hind tarsi and apices of tibiæ black; femora devoid of bristles, tibiæ and tarsi with strong yellow ones. *Wings* hyaline, greyish at apex; veins brown, the small transverse vein situated just beyond the middle of discal cell; the first posterior cell slightly narrower at border, the fourth closed far from border; anal cell very much narrowed at border, but open.

#### SAROPOGON, Loew.

Linn. Ent. ii. p. 439 (1847).

For species from New Zealand see Hutton, Trans. New Zealand Inst. xxxiii. p. 18 (1900), et p. 195 (1901).

The species as yet recorded from the Australasian Region are confined to Australia, Tasmania, and New Zealand, viz.:—

*Saropogon sergius*, Walker, List Dipt. ii. p. 347 [*Dasypogon*] (1849), et vi. Suppl. 2, p. 477 [*Dasypogon*] (1854); Kertész, Cat. Dipt. p. 73 [*Lasiopogon*] (1909).—*Dasypogon festinans*, ♂, Walker, Dipt. Saund. i. p. 92 (1851), et List Dipt. vi. Suppl. 2, p. 405 (1854).

*Saropogon viduus*, Walker, List Dipt. ii. p. 354 et vi. Suppl. 2, p. 483 [*Dasypogon*] (1849); Hutton, Trans. New Zealand Inst. xxxiii. p. 19 (1901).

*Saropogon discus*, Walker, List Dipt. ii. p. 358 (1849), et vi. Suppl. 2, p. 483 [*Dasypogon*] (1854); Hutton, Trans. New Zealand Inst. xxxiii. p. 19 (1901).—*Saropogon hudsoni*, Hutton, l. c. p. 20.

*Saropogon suavis*, Walker, Trans. Ent. Soc. London, n. ser. iv. p. 327 [*Dasypogon*] (1857); Kertész, Cat. Dipt. p. 132 [*Dasypogon*] (1857).—*Dasypogon gamaras*, Walker, List Dipt. ii. p. 346 (1849), et vi. Suppl. 2, p. 486 (1854); Kertész, Cat. Dipt. p. 73 [*Lasiopogon*] (1909).

*Saropogon limbinervis*, Macquart, Dipt. Exot. Suppl. 5, p. 71 [*Dasypogon*] (1855); Bigot, Ann. Soc. Ent. France, (5) viii. p. 222 (1898).

*Saropogon antipodus*, Schiner, Novara Reise, Dipt. p. 166 (1868); Hutton, Trans. New Zealand Inst. xxxiii. p. 20 (1901).

*Saropogon semirufus*, Bigot, Ann. Soc. Ent. France, (5) viii. p. 414 (1878).

*Saropogon chathamensis*, Hutton, Trans. New Zealand Inst. xxxiii. p. 20 (1901).

*Saropogon clarkii*, Hutton, *l. c.* p. 19.

*Saropogon extenuatus*, Hutton, *l. c.* p. 21.

*Saropogon fugiens*, Hutton, *l. c.* p. 20.

*Saropogon fascipes*, Hutton, *l. c.* xxxiv. p. 195 (1901).

*Saropogon proximus*, Hutton, *l. c.* xxxiii. p. 19 (1901).

*Note*.—*Saropogon aphidus*, Wlk., from unknown locality. Type appears to be lost.

### *Saropogon sergius*, Walker.

*Dasypogon festinans*, ♂, Walker.

Type (♂) from New South Wales (presented by Haslar Hospital), in bad preservation.

A reddish species, with reddish-yellow *legs* and *antennæ*.

Length 15 mm.

*Face* covered with golden-yellow tomentum. *Moustache* of pale yellow bristles. *Palpi* ferruginous, with yellowish hairs. *Antennæ* reddish yellow; the first two joints with yellowish hairs and bristles, the third about one and a half times as long as the first two joints together. *Forehead* blackish, a broad black stripe extending to base of *antennæ*. Hind part of head with a thick fringe of yellow bristly hairs. *Thorax* (denuded) reddish brown, with black stripes. *Scutellum* reddish brown. *Abdomen* reddish brown, the first segment black; two black lateral stripes begin on the second and extend to posterior border of third segment. Genital organs prominent. Underside reddish yellow, shining. *Legs* reddish yellow. *Wings* (broken); Walker describes them as "colourless, with a slight tawny tinge on the fore part; wing ribs and veins black"; the small transverse vein beyond the middle of discal cell; the transverse vein closing the discal cell joins the fourth vein *just below* the fork.

*Dasypogon festinans*, a male type from unknown locality, is identical with this type.

From the description of *Dasypogon nitidus*, Macq., from Tasmania, it is possibly the same species as this.

### *Saropogon viduus*, Walker.

Type (♀) and others from New Zealand.

A wholly black species, with clear wings, clouded at apex.



Length 12-14 mm.

*Face* black, covered with grey tomentum. *Moustache* of long black bristles. *Palpi* black, with black hairs. *Antennæ* with many black hairs on the first two joints; the third joint bare, not much longer than the first two joints together. *Forehead* with black hairs. *Thorax* brownish black, with grey tomentose stripes; sides and breast black, with grey tomentum, which is more silvery white on the sides of breast. *Scutellum* with some grey tomentum. *Abdomen* black, somewhat shining, small silvery white spots appear on the sides usually from the second segment onwards. *Legs* black, with black bristles and hairs. *Wings* large, veins brown, apex tinged brown, small transverse vein beyond the middle of discal cell.

The co-type of *Saropogon clarkii* in Brit. Mus. Coll. is almost identical with the above type and specimens, also from New Zealand; the only difference apparent is the position of the small transverse vein of *wing*, which in Hutton's co-type is at or *below* the middle of discal cell and is clouded with brown, fore border tinged brown, not extending beyond the first submarginal cell. *Abdomen* more blue-black, with the white tomentose spots at side more apparent.

### *Saropogon discus*, Walker.

*Saropogon hudsoni*, Hutton.

Type (♀) and another from New Zealand, and a co-type of *Saropogon hudsoni*.

A black robust species with a broad black *abdomen*, red at apex. *Legs* red, tarsi blackish. *Wings* clear.

Length 12 mm.

*Face* covered with pale yellowish tomentum. *Moustache* of pale yellow bristles. *Palpi* black, with pale hairs. *Antennæ* black, the first two joints with black hairs and bristles, the third joint nearly once and a half as long as the first two joints together, the usual style present. *Forehead* blackish, with some long black hairs at sides. Hind part of head with black bristly hairs. *Thorax* blackish, with some tawny tomentum and indistinct black stripes; sides and breast with greyish tomentum. *Scutellum* black, covered with tawny tomentum. *Abdomen* black, sides and apex bright testaceous, the fifth and sixth segments being so on their posterior borders, and the last two segments entirely so. Underside reddish yellow. *Legs* reddish yellow; the tarsi

black; coxæ blackish, with grey tomentum. *Wings* hyaline, very faintly greyish at apex; veins brown; small transverse vein just beyond the middle of discal cell; anal cell very narrow at border.

The co-type of *Saropogon hudsoni*, presented to the British Museum by the late Capt. F. W. Hutton, is identical with the Walker type. He records his species from Mount Peel, Nelson.

*Saropogon suavis*, Walker.

*Dasypogon gamaras*, Walker.

Type (♂) from Australia.

A small, slender, reddish species, with a general resemblance to a *Leptogaster* species.

Length 11 mm.

*Face* covered with golden-yellow tomentum. Moustache of pale yellow bristles. *Palpi* ferruginous, with yellowish hairs. *Antennæ* (third joint destroyed): Walker describes them as "tawny, the third joint nearly linear, black above." *Forehead* blackish, covered with some golden-yellow tomentum. *Thorax* (denuded) reddish. *Scutellum* similar. *Abdomen* wholly reddish, slender. *Legs* reddish, middle and posterior femora and apices of posterior tibiæ black. *Wings* tinged yellow, veins brown, fourth posterior cell slightly narrowed at opening, the small transverse vein just beyond the middle of discal cell.

Though the third joint of *antennæ* is wanting, there is little doubt this species is a true *Saropogon*.

*Dasypogon gamaras*, a male type from unknown region, is identical, but a little larger, measuring 14 mm., and stouter; there is a tinge of black on the second and third segments of abdomen.

*Dasypogon analis*, Macq., Dipt. Exot. Suppl. 4, p. 369 (1849).—Type seen by me in Paris Museum may possibly be identical with this species. Head of type is gone. A small species with yellow abdomen. Wings clear, tinged yellow and slightly clouded on cross-veins; all posterior cells open. In Walker's types none of the black markings mentioned by Macquart are present.

*Saropogon limbinervis*, Macquart.

This species is placed in this genus by Bigot, who had Macquart's type before him.

It is described as black, the fifth segment of *abdomen* testaceous. *Legs* black. *Wings* with veins shaded brown. Length 6 lines. ♀.

*Saropogon antipodus*, Schiner.

Described as brown-red. *Face* golden yellow. *Antennæ* black-brown. *Thorax* with golden-yellow stripe and spots, scutellum and breast-sides golden yellow. *Abdomen* shining reddish, the first two segments partly black. *Legs* bright rusty yellow, femora with black stripe, tarsi brownish. *Wings* tinged very pale brownish yellow, with brown veins; the second posterior cell very narrow at base, the fourth narrowed a little at opening.

Length 6 lines.

Auckland. One female.

*Saropogon semirufus*, Bigot.

From Australia.

A species described as red and black. *Face* with a shining black stripe. *Abdomen* blackish, red at sides and apex. *Antennæ* fawn-coloured. *Wings* pale brown.

Length 12 mm.

*Saropogon clarkii*, Hutton.

Co-type (♂) in Brit. Mus. Coll., presented by Capt. F. W. Hutton, from New Zealand.

A large black species. *Face* brownish, with whitish-grey tomentum. Moustache black, composed of stout bristles. *Forehead* with bristly black hairs. *Thorax* with two grey tomentose narrow stripes; shoulders grey tomentose and *scutellum* the same. *Abdomen* blue-black, shining; genital organs black, with black pubescence. *Legs* wholly black. *Wings* hyaline, tinged brown on the fore border at base and where the second vein has its origin.

Length 16 mm.

*Saropogon fugiens*, Hutton.

Co-type (♂) presented by Capt. F. W. Hutton, from New Zealand; males and females from same locality (*Hudson, Cochrane*).

A blue-black species with golden tomentum on face, on sides and dorsum of *thorax*, and on *scutellum*. *Legs* reddish, the femora blackish above; tibiae black at apices, largely so

on the posterior pair. *Wings* hyaline or clouded brown, small transverse vein just beyond the middle of discal cell. *Abdomen* blue-black, shining; in some of the specimens a reddish line at sides is visible; genital organs in male black, with black pubescence; in female a circlet of spines at apex of abdomen.

Length of co-type 12 mm.

#### ACNEPHALUM, Macquart.

Dipt. Exot. i. (2) p. 167 (1838).

One species is recorded from Australia.

*A. punctipenne*, Macq. Suppl. 5, p. 71 (1854), unknown to me. The type of *A. coon*, Walker, from unknown locality, is not to be found in the Brit. Mus. Coll.

#### MICROSTYLUM, Macquart.

Dipt. Exot. i. (2) p. 142 (1838).

One species, *M. testaceum*, Macq. [*Dasypogon*] Suppl. 1, p. 188 (1844), is recorded from Australia. Unknown to me, and not in the Paris Museum.

It is described as testaceous; the *abdomen* black, apex testaceous. *Legs* black, the femora testaceous. *Wings* yellow, the fourth posterior cell closed.

Length 12 lines.

#### PHELLUS, Walker.

Dipt. Saund. i. p. 110 (1851).

This genus was formed for one species.

#### *Phellus glaucus*, Walker.

Dipt. Saund. i. p. 110, pl. iv. fig. 6 (1851); id., List Dipt. vi. Suppl. 2, p. 503 (1854); Froggatt, Australian Insects, p. 300, pl. xxviii. fig. 12 (1907).

Type (♀) and another from West Australia. Two males from Swan River, W. Australia. Froggatt states that it is found in the interior of W. Australia.

This genus is not identical with *Phoneus*, Macq., or *Obelophorus*, Schiner, as suggested by this latter author, but is probably nearly related to the latter genus peculiar to Chili, from which it is distinguished by the short stout prolongation on the middle tibiae. The *face* is covered with hairs, the *forehead* broad, the ovipositor of female long, the abdomen hairy, the antennae with a long third joint. The



wing with an appendix and the first posterior cell narrowed at opening, the fourth and anal cell closed. The legs are stout and hairy, more especially the hind tarsi and apex of hind tibiæ; the curious prolongation of middle tibiæ is short, armed with very stout short spines on outer border, and on inner border with thick hairs.

### CODULA, Macquart.

Dipt. Exot. Suppl. 4, p. 374 (1849).

This genus, formed by the author for *C. limbipennis* from New South Wales, is allied to his genus *Brachyrrhopola*, to which his second species of *Codula* belongs, but it is at once distinguished by the absence of the curved spine on fore tibiæ, the moustache is composed of fewer hairs and confined to the oral opening, and the abdomen is stouter and shorter. With Macquart's second species and one placed by Bigot in this genus transferred to *Brachyrrhopola*, only Macquart's typical species and one nearly allied to it remain in the genus.

*Codula limbipennis*, Macq., Dipt. Exot. Suppl. 4, p. 374, pl. vii. fig. 2 (1849).

*Codula vespiformis*, Thoms., Eugen. Resa, Diptera, p. 464 (1869).

### *Codula limbipennis*, Macquart.

Type ♂ seen in Paris Museum by me, from E. Australia. A species with a stout club-shaped abdomen, black and yellow in colouring. Wings deep brown on fore border.

*Face* black, covered with bright yellow tomentum, leaving a black stripe in the middle. Moustache composed of five or six long yellow bristly hairs. *Palpi* black, with black pubescence. *Antennæ* long, the third joint twice as long as the first two together, yellow. *Thorax* black with dull yellowish tomentum, two bright orange spots above the shoulders. *Abdomen* black, with bright orange tomentum beginning from the posterior border of the third segment, the fourth entirely black in the centre, the other segments wholly covered with the bright orange tomentum; under-side black, with two orange-coloured segmentations only. *Legs* black, knees and hind tibiæ yellow. *Wings* clear, deep brown on the fore border, extending through both basal cells, then in a straight line to the apex, bordered by the third vein, not extending beyond its first forked branch.

Macquart's description is as follows:—

Thorax black. Abdomen red. Legs black; tibiæ red.

Wings brown on external border. Length 5 lines ♂. Palpi with black hairs. Beard black. Face with yellow tomentum: a black denuded space under the antennæ; moustache black. Forehead black. Antennæ fawn-coloured, the third joint brown at apex. Thorax dull with some grey tomentum, the shoulder spot fawn-coloured; sides shining. Abdomen: the first, second, and anterior border of third segment black, the remainder bright fawn-coloured; the fourth with a large blackish transverse dorsal spot, the seventh very small, black; underside wholly shining black. Femora fawn-coloured at apices; anterior and intermediate tibiæ black, at base fawn-coloured; posterior pair fawn-coloured. Anterior and intermediate tarsi black, posterior pair fawn-coloured. Wings hyaline, with a wide brown fore border; base of the second submarginal cell very narrow.

From east coast of New South Wales.

*Codula vespiformis*, Thomson.

One male from Burpengary, Queensland, in Brit. Mus. Coll.

Thomson described his type, a male from Sydney, as related to *C. limbipennis*, Macquart, but easily distinguished by the colour of abdomen.

*Face* golden yellow with a short black median stripe, raised at oral opening, which is covered by the moustache composed of yellow bristles. *Antennæ* reddish yellow; the third joint long cylindrical, notched on upper border, no style apparent. *Forehead* black, shining, with some grey and black hairs. *Thorax* black, with golden yellow tomentose spots on prothorax, shoulders, and two spots on lower border the same colour; one stout fulvous spine-like bristle at side of thorax above base of wing. *Scutellum* black, with horizontal golden-yellow tomentose stripes. *Abdomen* club-shaped, black, reddish golden tomentose on posterior border of second segment as a narrow band, a similar but wider band on posterior border of third segment, a very narrow one on posterior border of fourth, and fifth and sixth wholly reddish golden except at the sides; underside wholly black; on sides of first segment appears a small black bristle. *Legs* reddish yellow; femora with exception of apices black, apices of fore tibiæ and the tarsi fuscous. *Wings* hyaline, fore border deep brown, reaching the discal cell and almost filling up the basal cells, on apical half it does not extend beyond the third vein; all cells open, the fourth posterior and anal cells narrowed at border.

Length of specimen 15 mm.

BATHYPOGON, Loew.

Progr. Realschule, Meseritz, 1851, p. 13 (1851).

This genus was formed by Loew for his species *B. asili-formis* from Australia, and Schiner added *B. brachypterus*, Macq., besides other species from Chili.

The genus belongs to the group of *Dasypogoninæ* with no spine on fore tibiæ and is distinguished by the rather short wings with the fourth posterior cell closed and the first widely open, the vein closing the fourth posterior cell is nearly on a line with the one closing the discal cell; the face has a distinct tubercle, with the moustache reaching the antennæ, which have a style-like bristle on the end of the third joint. It appears to be distinguished from *Stenopogon* by the broader face.

The statement in Schiner's table that the wings in this genus in proportion are long and narrow, is somewhat misleading, so far as concerns its relationship to the other Australian genera of *Dasypogoninæ*, from which it is clearly distinguished by the rather short narrow wings, often not reaching far beyond half the length of the abdomen.

The following described and one new species, all from Australia, now belong to this genus.

The differences between some of the species are very small and probably with the advent of fresh material some will hardly be maintained as distinct.

*Bathypogon brachypterus*, Macq., Dipt. Exot. i. (2) p. 160, pl. iii. fig. 3 [*Dasypogon*] (1838); id., Suppl. ii. p. 50 [*Dasypogon*] (1847); Rond. Nuov. Ann. Sci. Nat. Bologna, (3) ii. p. 105 [*Astylum*] (1850).—*Proctacanthus postica*, Walker, List Dipt. vii. Suppl. 3, p. 655 (1855).

*Bathypogon aoris*, Walker, List Dipt. ii. p. 321 [*Dasypogon*] [*Xiphocerus*] (1849), et vi. Suppl. 2, p. 480 [*Dasypogon*] (1854); Kertész, Cat. Dipt. p. 100 [*Ancylorrhynchus*] (1909).—*Bathypogon asili-formis*, Loew, Progr. Realschule, Meseritz, 1851, 31 (1851). ? *Asilus mutillatus*, Walker, List Dipt. vii. Suppl. 3, p. 739 (1855).

*Bathypogon pedanus*, Walker, List Dipt. ii. p. 320 [*Dasypogon*] (1849), et vi. Suppl. 2, p. 481 [*Dasypogon*] (1854); Kertész, Cat. Dipt. p. 102 [*Ancylorrhynchus*] (1909).

*Bathypogon testaceovittatus*, Macq., Dipt. Exot. Suppl. v. p. 70, pl. ii. fig. 1 [*Dasypogon*] (1855); Bigot, Ann. Soc. Entom. France, (5) viii. p. 221 (1878).

*Bathypogon maculipes*, Bigot, Ann. Soc. Entom. France, (5) viii. p. 433 (1878).

*Bathypogon nigrinus*, sp. n.

- |  |                             |
|--|-----------------------------|
| 1. Tibiæ reddish .....   | 2.                          |
| Tibiæ black .....  | 3.                          |
| 2. Femora red and black; bristles on legs and thorax chiefly white ..... | <i>brachypterus</i> , Macq. |

- |   |                          |
|---|--------------------------|
| Femora red and black; bristles on legs and thorax chiefly black ..... | <i>nigrinus</i> , sp. n. |
| Femora black; bristles on legs white, on thorax black .....           | <i>pedanus</i> , Wlk.    |
| 3. Bristles on legs and thorax chiefly white ....                     | <i>aoris</i> , Wlk.      |

*Bathypogon brachypterus*, Macquart.

*Proctacanthus postica*, Walker.

This species is erroneously placed in Kertész's catalogue under *Astylum*, a genus formed by Rondani for a species from Venezuela with no terminal bristle or style to the third joint of antennæ.

Type (♀) from New S. Wales seen by me in Paris Museum, 12. 4. 11.

In Brit. Mus. Coll.: type of *Proctacanthus postica*, Walker, from Melbourne (Mr. Baby's coll.), a female from New S. Wales (Saunders coll.), and another from Mackay, Queensland (G. Turner) (1894). In Mr. French's coll. a female from Victoria.

Macquart's description is as follows:—

Black. Abdomen ashy grey below. Femora and tibiæ red below.

Length 8 lines. ♀.

Face and forehead yellowish grey; moustache reaching to the base of antennæ, yellowish white; the upper hairs black. Beard and hairs of palpi white. Hind part of head with yellow hairs. Antennæ black. Thorax black; stripes on side and scutellum with grey tomentum. Abdomen black, with scattered small yellow hairs; sides and belly ashy grey. Legs: femora and tibiæ red; with a black stripe above, which is wider on the posterior ones; posterior legs black; tarsi black, with yellow hairs, which are also present on the tibiæ. Wings rather short, slightly yellowish; brownish at the apex; the fourth posterior cell closed, with a very oblique posterior vein, the posterior vein of fork of third vein longer than the anterior one.

New South Wales.

The antennæ have a short terminal style. Moustache black above, then yellow. In the specimens before me there are no black hairs on upper part of moustache. The small cross-vein of wing is situated slightly beyond the middle of the discal cell.

Length of specimens 18–20 mm.

Walker's type is probably a specimen of this species; the type is in very bad preservation.



*Bathypogon aoris*, Walker.*Bathypogon asiliformis*, Loew.? *Asilus mutillatus*, Walker.

Type female from Adelaide (Ent. Club), other females and males from Mackay, Queensland (G. Turner) (1891), and Burpengary, Queensland (Dr. T. L. Bancroft), 1904.

Distinguished from *Bathypogon brachypterus* by the wholly blackish femora, and by the blackish tibiæ, bristles on *legs* chiefly yellowish, the small cross-vein of *wing* is situated about the middle of the discal cell.

Two of the females and one male from Queensland have the femora largely reddish as in *B. brachypterus*, but the tibiæ remain blackish; perhaps eventually the two species may be merged in one.

Length 17–26 mm.

The type of *Asilus mutillatus*, Walker, from Australia, abdomen missing, is evidently a species of this genus, apparently similar to *B. aoris*, with the exception of the small cross-vein of wing, which is distinctly below the middle of the discal cell.

Loew suggested that his species *B. asiliformis* might be identical with *Dasypogon plumbeus*, Fabr. (Ent. Syst. iv. p. 382; id. Syst. Antl. p. 165; Wiedem. Ausszweifel. Ins. i. p. 413 [*Asilus*]; see Kertész's Cat. for further refs.), but that the description of this last is too poor to serve for recognition of the species, and further concluded *Dasypogon bæbius*, Walker (List Dipt. ii. p. 333), placed in the same group as *Dasypogon plumbeus* by Walker, might be identical; this last type is apparently destroyed, not being in the Brit. Mus. Coll. From Loew's description his species is evidently identical with *B. aoris*. The Fabrician and Walker species might well be deleted from list.

*Bathypogon pedanus*, Walker.

Type (♀) and another from Swan River, W. Australia (Ent. Club).

Distinguished from *B. brachypterus* by the wholly black femora, and from *B. aoris* by the pale reddish tibiæ; the posterior pair are darker. *Thorax* black, with very distinct whitish-grey sides; shoulders red.

Length 18 mm.

*Bathypogon testaceovittatus*, Macq., said by him to be

allied to *Bathypogon uoris*, Walker, was placed by Bigot in this genus, probably correctly, judging from the figure of *wing* given by Macquart; it is described by him as having the sides of *thorax* and *abdomen* testaceous. If the figure of the *wing* is correct this species is distinguished by the rounded angle of the anterior branch of the fourth vein emitted from the discal cell.

*Bathypogon maculipes*, Bigot, from Australia, measuring 22 mm., is described as having the anterior and intermediate femora black, but reddish in the middle, and the posterior pair with an elongated reddish spot. The anterior tibiæ with a similar smaller reddish spot, the bristles of tibiæ whitish.

Neither of these species is known to me.

*Bathypogon nigrinus*, sp. n.

Type (♂) and a series of males and one female from Burpengary, S. Queensland (*Dr. T. L. Bancroft*).

A species very similar to *B. brachypterus*, Macq., but distinguished by the black (not yellow) bristles on the *legs* (yellow bristles are only present on the fore tarsi) and by the paler indistinct red of the fore tibiæ, which are covered with short white pubescence, and by the first two joints of *antennæ* being red, not black.

Length 16–18 mm.

*Face* reddish, with some little grey tomentum, at the sides of the face and below the antennæ appearing grey, being covered with a silvery white and grey tomentum; the tubercle large, taking up most of the face; moustache reaching its whole length, formed of strong black bristles, with a few white ones below. *Palpi* black, with yellowish-white hairs. Beard white. *Antennæ* black; the first two joints red, with yellowish-white long hairs; the first joint twice the length of the second, the third broad, with a style-like ending. *Forehead* black, with yellowish-grey tomentum, which is silvery-white above antennæ; pubescence of black hairs, at vertex very stout, black, spine-like bristles; round head white hairs. *Thorax* brownish, with two median and side black stripes, posteriorly covered with silvery-grey tomentum, which also covers the sides. *Scutellum* black, bordered with same-coloured tomentum and with black bristles. Sides of thorax with long black bristles. *Abdomen* black, covered with short white hairs and with black bristles at the segmentations; sides covered with grey

tomentum; underside blackish. *Legs* armed with bristles, which are black, on the fore tarsi some yellow ones; coxæ red, with white tomentum and long white hairs and one black bristle below; femora black above, with white pubescence, below red, with long white hairs; tibiæ yellowish red on the outside, black on the inside, with white pubescence; underside of fore tarsi with yellow pubescence; tarsi reddish, covered with white pubescence. *Wings* hyaline, brownish at apex and on posterior border; the small transverse vein oblique, about the middle of the discal cell; the fourth posterior cell and the anal closed; the transverse veins closing the discal and fourth posterior cell are not quite in a straight line. Halteres reddish yellow.

### STENOPOGON, Loew.

Linn. Ent. ii. p. 453 (1847).

The genus is distinguished by the very narrow *face*, with a keel-shaped tubercle, the face becoming narrower still at antennæ, the moustache reaching nearly to the antennæ. *Wings* with the first posterior cell more or less narrower at border, the fourth closed or open. In the Australian species the front posterior cell is hardly narrower at border.

The following species are recorded from Australia:—

- Stenopogon elongatus*, Macq., Dipt. Exot. Suppl. 1, p. 194, pl. vii. fig. 6 (1844), et Suppl. 2, p. 50 [*Dasypogon*] (1846).—*Dasypogon flavifacies*, Macq., l. c. Suppl. 4, p. 368, pl. vi. fig. 6 (1849). *Dasypogon digentia*, ♂, Walker, List Dipt. pt. ii. p. 316 (1849), et part vi. Suppl. 2, p. 480 (1854); Kertész, Cat. Dipt. p. 101 [*Ancylorrhynchus*] (1909). *Dasypogon lanatus*, ♀, Walker, l. c. p. 317, et part vi. Suppl. 2, p. 486 (1854); Kertész, l. c. [*Ancylorrhynchus*] (1909). *Dasypogon thalpius*, ♂, Walker, l. c. p. 317, et part vi. Suppl. 2, p. 481 (1854); Kertész, l. c. [*Ancylorrhynchus*] (1909). *Dasypogon agave*, Walker, l. c. p. 317, et pt. vi. Suppl. 2, p. 480 (1854). *Stenopogon fraternus*, Bigot, Ann. Soc. Ent. France, (5) viii. p. 421 (1878).
- Stenopogon nicoteles*, ♂, Walker, List Dipt. pt. ii. p. 320 (1849), et pt. vi. Suppl. 2, p. 481 [*Dasypogon*] (1854); Kertész, Cat. Dipt. p. 102 [*Ancylorrhynchus*] (1909).

### *Stenopogon elongatus*, Macq.

- Dasypogon flavifacies*, ♀, Macq.  
*Dasypogon digentia*, ♂, Walker.  
*Dasypogon lanatus*, ♀, Walker.  
*Dasypogon thalpius*, ♂, Walker.  
*Dasypogon agave*, ♂, Walker.  
*Stenopogon fraternus*, Bigot.

Macquart's types both seen by me in Paris Museum, 12. 4. 11. *S. elongatus*, ♂ ♀, from New South Wales; *D. flavifacies*, a female (not a male) from Tasmania.

In Brit. Mus. Coll.:—

Type of *D. digentia*, a male from New South Wales. Haslar Hospital.

Type of *D. lanatus*, a male from Van Diemen's Land (*J. Brynce*).

Type of *D. thalpius*, a male from Perth, W. Australia (*G. Clifton*).

Type of *D. agave*, a male from Swan River, W. Australia.

Also a series of males and females from S. Australia, Tasmania, Queensland, and W. Australia.

Macquart's description is as follows:—

Elongated, black. Abdomen narrow, the apex testaceous. Moustache golden. Antennæ black. Legs testaceous.

Length 9 lines. ♂ ♀.

Palpi black, with black hairs. Face black; moustache and beard golden yellow, the first reaching the antennæ. Forehead black, with black hairs. Antennæ black; the first joint a little elongated, with black hairs below. Thorax black, with black hairs; sides with greyish-yellow tomentum and whitish hairs. Abdomen narrow, 6 lines long, black, with whitish tomentum and long whitish hairs below; genital organs a little swollen, testaceous; the anterior half of the last two segments testaceous. Legs with black bristles and whitish hairs; anterior femora black, testaceous at the apex, posterior ones black, the posterior half below testaceous; tibiæ black at apex; anterior tibiæ with no spines; tarsi black. Wings clear, a little yellowish; apex slightly brownish.

From New South Wales. Coll. M. Fairmaire and M. Bigot. One specimen in the coll. of Marquis Spinola comes from Sydney Island, Oceania.

Macquart further remarks, in the second Supplement, that the species which appears common in Tasmania affords him several subforms. One female differs from the type by the entire black abdomen, ovipositor, and femora; another has the femora entirely testaceous; in the males the abdomen is black and the genital organs blackish testaceous.

These remarks are fully borne out by an examination of Walker's type and others in the Brit. Mus. Coll. *D. digentia* has the abdomen entirely black. In some specimens the testaceous colouring, if present, is confined to the last segment. The bristles on the legs are often fulvous instead of



black or partly so. Macquart's type of *D. flavifacies* has the abdomen and femora entirely black.

Length of specimens, males from 17–23 mm., females from 20–25 mm.

*Stenopogon fraternus* from the description is no doubt the same as *S. elongatus*.

*Stenopogon nicoteles*, Walker.

Type (♂) from Swan River, West Australia (Dr. Richardson).

A small black species allied to *S. elongatus*, but the moustache is silvery white below, with black hairs above. *Face* black, covered with silvery-white tomentum. *Thorax* black, with grey tomentose stripes. *Abdomen* black, covered with brownish tomentum. *Legs* black, the tibiæ pale reddish yellow, the posterior pair almost wholly blackish; bristles on legs pale yellow. *Wings* hyaline; small transverse vein below the middle of discal cell.

Length  $14\frac{1}{2}$  mm.

PSILOZONA, gen. nov.

Formed for two species from Queensland.

Blue-black shining species. Fore and middle tibiæ and tarsi fringed with hairs, the tarsi broad. *Wings* with the fourth and anal cells closed, the veins closing the fourth posterior and discal cell almost parallel. *Face* shining, broad, somewhat raised above oral opening; the moustache composed of strong bristles, not confined to the oral opening, but not extending up the face; the *forehead* broad, shining, with hairs at sides. Head broader than it is high, excised in centre. Fore tibiæ have no curved spine. *Antennæ* with a distinct style.

*Psilozona albitarsis*, sp. n.

One male type and two females (type 1903) from Townsville, Queensland (F. P. Dodd), 1904 and 1903.

A blue-black species, with brownish *wings*. The male with white-haired fore tarsi and the base and apex of *abdomen* white-haired. Female with *abdomen* bare, long, and pointed at apex, the fore tibiæ with black hairs.

Length, ♂ 17, ♀ 23 mm.

♂. *Face* black, shining, with whitish tomentum at the

sides. Moustache composed of numerous strong black bristles, with some yellowish ones below, not extending to the sides, which have soft whitish pubescence. *Palpi* black, clothed with coarse, white, fairly long hairs, and with some stout black bristles at the apices. Proboscis slightly longer. Beard of thick white pubescence. *Antennæ* black, the third joint reddish yellow, the first two joints with black hairs, the third bare, with a distinct style, longer than the first two joints together and broader. *Forehead* black, with grey pubescence. Hind part of head with whitish hairs. *Thorax* black, with sparse greyish pubescence on the dorsum; the shoulders covered with ashy-grey tomentum; two stripes of grey tomentum apparent; sides whitish, with white pubescence; breast-sides black, with a broad horizontal whitish stripe and white pubescence; one long black bristle on side of thorax beyond the transverse suture and three shorter ones below on the breast-sides just above the suture. *Scutellum* black, with long whitish pubescence. *Abdomen* bluish, shining, the first three segments with whitish pubescence, fourth and fifth with very short, chiefly black pubescence, sixth and seventh with bristly yellowish hairs; anus with similar hairs; sides of abdomen with white hairs, except on the fourth and fifth segments, where it is short and black. *Legs* black, slender, the middle and anterior tibiæ and tarsi with thick fringes of black hairs, replaced on the fore tarsi by white hairs, which cover the tarsi on upper sides and are very noticeable. Hind tibiæ and tarsi armed with some short black bristles. *Wings* hyaline, brown on basal half, extending to the apex of first basal cell, and to the base of the discal cell, filling most of the anal cell, leaving the axillary to be almost hyaline; veins brown, the fourth posterior and anal cell closed, the transverse veins closing discal and fourth posterior cells almost parallel, the fourth at base not pedunculated, the small transverse vein situated beyond the middle of discal cell.

*Female* similar. *Abdomen* longer and pointed, the pubescence much less and shorter, white on the first two segments, then black; the first segment is blackish, the next three purplish, the remaining ones blue, metallic, shining; sides with short white hairs, intermixed with black on the first three segments, then black and shorter. *Legs*: the pubescence is wholly black. *Face* with the sides more widely covered with light tomentum, which is golden yellow; the hairs on first two joints of *antennæ* are yellow below, the hairs on palpi yellowish. *Wings* more wholly brown, only

the apex and centres of fourth and fifth cells and axillary lobe being hyaline.

*Psilozona nigratarsis*, sp. n.

Three males from Townsville, Queensland (*F. P. Dodd*), 1903.

A species very similar to *P. albitarsis*, but distinguished by the pale *wings*, the absence of white hairs on the fore tarsi, and by the presence of *four* black bristles on the breast-side just above the transverse suture in the type only. The moustache has more yellow hairs and fewer black bristles, the colouring on sides of *face* is golden yellow; the hairs on *palpi*, on lower part of the first two antennal joints, composing the beard, and round head are yellowish. *Thorax* not quite so pubescent. *Abdomen* with whitish pubescence only at base and a little short, scattered, white pubescence on the apex. The pubescence on fore legs less thick.

Length 18 mm.

DAMALIS, Fabr.

Syst. Antl. p. 147 (1805).

Only one species is recorded from Australia:—

*Damalis fuscipennis*, Macq., Dipt. Exot. Suppl. 1, p. 222 (1844).

This must be nearly allied to *Damalis pandens*, Walker, Proc. Linn. Soc. London, iv. p. 104 [*Discocephala*] (1860), from Celebes, the type in the Brit. Mus. Coll.; but that of *Damalis lugens*, Wlk., from New Guinea, is not to be found.

Doleschall recorded one species, *Damalis erythrophthalmus*, from Amboina.

ANCYLORRHYNCHUS, Latreille.

Fam. Règn. Anim. p. 490 (1825).

*Xiphocera*, Macq., Suites à Buffon, i. p. 279 (1834).

See Kertész, Cat. Dipt. p. 100, for other synonyms.

This genus has not been recorded from Australia itself. All the Walker species placed in it in Kertész's Cat. belong to other genera; v. d. Wulp records one species from the Island of Waigou, *X. complacita*, and Doleschall one from Amboina, *X. rufithorax*.

## HETEROPOGON, Loew.

Linn. Ent. ii. p. 488 (1847).

*Dasypogon bæbius*, Walker, is recorded from Australia. The type is not to be found in the Brit. Mus. Coll. It probably does not belong to this genus, in which it is placed in Kertész's Cat.; but, as stated above, Loew suggests it may be a *Bathypogon* species.

The following Walker species from unknown localities also placed here by Kertész do not belong to this genus, having curved spines on fore tibiæ, and the fourth posterior cell is closed, in line with the transverse vein closing discal cell; they appear to belong to a genus near *Deromyia*:—*ægon*, *animetus*, *cerretanus*, *copreus*, *silanus*, *politus*. Generically similar are *carvilius* under *Oligopogon* in Kertész's Cat., and *volcatus* under *Isopogon*; they do not appear to be from Australia.

*Dasypogon fossius*, Walker, from unknown locality, is exactly similar to specimens labelled the same from S. Africa, and is evidently a South-African species; it has spines on the fore tibiæ.

[To be continued.]

## BIBLIOGRAPHICAL NOTICES.

*A Revision of the Ichneumonidæ, based on the Collection in the British Museum (Natural History), with Descriptions of new Genera and Species.* Part I. *Tribes Ophionides and Metopiides.* By CLAUDE MORLEY, F.Z.S., F.E.S. London: Printed by Order of the Trustees of the British Museum. 8vo. 1912. Pp. xi, 88. Coloured plate.

LITTLE was done to elucidate the collection of Ichneumonidæ in the British Museum since it was arranged by Frederick Smith in 1860 until Mr. Morley recently took up the work, and the present small volume is published as a first instalment. It includes a list, generally with comments and often with full descriptions, of 198 species of Ophionides and 33 Metopiides, and 5 genera and about 70 species are described as new. The coloured plate is an admirably enlarged diagram of the common and widely distributed *Ophion luteus*, L., illustrating its structure and neurulation.

W. F. K.



*Records of the Indian Museum. (A Journal of Indian Zoology.)*  
Vol. iv. no. x. Issued March 30th, 1912. *Annotated Catalogue of Oriental Culicidæ. Supplement.* By E. BRUNETTI. Calcutta, 1912. Pp. 403-516.

MR. BRUNETTI'S "Annotated Catalogue of Oriental Culicidæ" was published in 1907 in the 'Records of the Indian Museum,' i. pp. 247-377; and a vast amount of fresh material has now accumulated, which is exhaustively discussed and criticized in the present Supplement. The "Additions to the List of Literature" (pp. 411-413) alone contain 57 items, many of these being works of primary importance. It is impossible for us to do more here than direct the attention of dipterists to this most important publication.

W. F. K.

## PROCEEDINGS OF LEARNED SOCIETIES.

### GEOLOGICAL SOCIETY.

May 1st, 1912.—Dr. Aubrey Strahan, F.R.S., President,  
in the Chair.

The following communication was read:—

'Insect-Remains from the Midland and South-Eastern Coal-fields.' By Herbert Bolton, F.R.S.E., F.G.S., Director of the Bristol Museum.

The writer describes a series of three insect-wings obtained by Dr. L. Moysey, F.G.S., from the Shipley Clay-pit near Ilkeston (Derbyshire), and a blattoid wing, and three fragments from the borings of the Kent Coal Concessions Company, Ltd., in East Kent.

The first series of insect-wings occur in greyish-brown ironstone nodules, which lie in bands in a yellow clay about 30 or 40 feet below the Top Hard Coal.

The East Kent insect-remains occur in core shales, the horizon of which is not yet determined.

The wings obtained by Dr. Moysey are not referable to any known families. Three new families are formed to contain them, one of which is nearly related to the Dictyonuridæ with some suggestion of the family Heliolidæ. A second new family is allied

to the Heliolidae, and the third new family to the Homiopteridae, or, as the writer believes, near to the Lithomantidae.

The East Kent insect-remains contain one wing, referable to the genus *Soomylacris* (*Ettoblattina*), a species of which is already known from the Forest of Dean Coalfield.

The finding of two species of the same genus in coalfields so widely separated as those of the Forest of Dean and East Kent is not without interest, in view of the generally-accepted belief in the former continuity of the Coal Measures across the South of England.

June 5th, 1912.—Prof. W. W. Watts, Sc.D., LL.D., F.R.S.,  
Vice-President, in the Chair.

The following communications were read:—

1. 'The Further Evidence of Borings as to the Range of the South-Eastern Coalfield and of the Palæozoic Floor, and as to the Thickness of the Overlying Strata.' By Hon. Professor W. Boyd Dawkins, M.A., D.Sc., F.R.S., F.S.A., F.G.S.

In this paper the Author gives an outline of the history of the experimental borings made in order to verify Godwin-Austen's theory concerning 'the Axis of Artois,' which led to the discovery of the South-Eastern Coalfield. The first of these was at Netherfield (1872–75) near Battle (Sussex). Here the borehole, ending in Oxford Clay at a depth of 1905 feet below the surface, showed that the Palæozoic floor is buried under so great a thickness of rock that it was advisable to look farther north for a site for further experiments. The second boring (1886–92), under the Shakespeare Cliff, Dover, on the site of the Channel Tunnel works, resulted in the discovery of the Coal Measures belonging to the Pennant or Middle Series of the Bristol and South Wales Coalfields, at a depth of 1100 feet below O.D. This affords a practical basis for further exploration. The extension of the coalfield to a distance of 8 miles north of Dover was proved by the boring (1897–99) at Ropersole, where the same Pennant Series occurred at 1180 feet below O.D., and its extension in the intervening area about 5 miles to the west of Dover by a boring under the direction of M. Breton at Ellinge (1901–1902), where the coalfield was struck at 1286 feet below O.D.

In these three borings the strata of the Coal Measures are practically horizontal, a fact which, in the opinion of the Author, implies that they form the bottom of a syncline with its long axis passing from Dover in a north-westerly direction parallel to the scarp of the North Downs.

The boring at Brabourne (1897–98), under the direction of Mr. Brady and the late Mr. Etheridge, gave the next fixed point in the enquiry. It established the fact that, at the base of the North Downs, the Palæozoic floor consists of highly inclined strata (in the opinion of the Author, of Devonian age) at 1789 feet below O.D.

These are covered by Dolomitic Conglomerate and Triassic marls, the section being identical with that of the Mendip Hills in Somerset. It therefore marks the position in Kent of the Pembroke-Mendip anticline which forms the southern boundary of the Coalfields of Bristol and of South Wales. It follows that the south-western boundary of the South-Eastern Coalfield is to be looked for at a sufficient distance east of Brabourne to allow of the presence of the Carboniferous Limestone and Millstone Grit, as shown approximately on the map.

These results, laid by the Author before the Royal Coal Commission in 1903, led to further experiments under his direction. The first of these, at Waldershare (1904-1907), proved the existence of the Coal Measures at 1069 feet below O.D., in two distinct groups, the upper belonging to the Pennant Series as before with an average dip of  $10^{\circ}$ , and the lower with an average dip of  $20^{\circ}$ , belonging to the Lower Group of Coal Measures of Somerset, Gloucester, and South Wales. The second at Fredville (1905-1907), 3 miles north-east of Waldershare, reached the Palæozoic floor at 1109½ feet, and entered the same lower series of valuable coal-seams, dipping at an angle of  $17^{\circ}$  (Journ. Roy. Soc. Arts, vol. lv, 1907, pp. 456-57). Further experiments have been carried on north and east of Dover, but their results are not yet available for scientific purposes. Thus a valuable coalfield has been proved over a large area, with its eastern and western boundaries as yet undetermined, as shown on the map.

Two further experimental borings to the north and west, carried out under the Author's direction in 1910-11, led to most unexpected results. Hitherto the Coal Measures were either horizontal, or dipping in the normal fashion without signs of faulting, and there was every reason to believe that the Coal-Measure trough would be struck, on the first site, at Chilham, about 3 miles south-west of Canterbury. Instead, however, of Coal Measures, Upper Silurian shales with *Monograptus priodon* formed the Palæozoic floor at 1072 feet below O.D. In the second, at Bobbing near Sittingbourne, hard Silurian grits and shales occurred at 1070 feet below O.D. In both borings the Silurian rocks are nearly vertical, and bear marks of crushing. The northern boundary of the South-Eastern Coalfield is therefore to be sought in the district between Fredville and Chilham, and probably nearer to the former locality than to the latter.

The Silurian portion of the buried Palæozoic floor is then traced westwards through Cliffe, on the Thames below Gravesend, to Ware in Hertfordshire, and northwards through Essex to Harwich, Sutton, and Culford (Bury St. Edmunds). To the south of this the Devonian rocks occupy the area of London, and extend as far as the district of Croydon.

The varying thickness of the overlying rocks is also dealt with, and details are given of three sections, at Ropersole, Chilham, and Bobbing, in the hope that they may be useful to other explorers.

2. 'Shelly Clay dredged from the Dogger Bank.' By John Walker Stather, F.G.S.

The Dogger Bank fishermen frequently get in their nets a tough peaty material, which they call 'moorlog.' In a paper published in the 'Essex Naturalist,' April and July, 1909, this 'moorlog' was described by Mr. H. Whitehead and Mr. H. H. Goodchild, with a report on the plant-remains by Mr. Clement Reid, F.R.S., and Mrs. Eleanor Reid.

In looking over some recently dredged 'moorlog' brought in by a Hull trawler, the Author noticed that, adhering to the specimens of 'moorlog,' was a dark silty clay, full of marine shells. These specimens of 'moorlog,' with the associated shelly clay, were dredged in lat.  $55^{\circ} 24'$  N., and long.  $3^{\circ} 10'$  E., at a depth of 20 fathoms.

A collection of these shells was submitted to Mr. Clement Reid, who stated that they are all assignable to very shallow-water species, and probably flourished just beneath low-water level. This and other evidence seems to show that the 'moorlog' in this part of the North Sea rests upon a bed of shelly silt, and the shells in the silt together with the 'moorlog' point to great changes of level in the North Sea Basin.

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## MISCELLANEOUS.

### EDITORIAL NOTE.

It is with great regret that we have to announce the retirement of Dr. GÜNTHER from the co-editorship of the 'Annals,' owing to failing sight.

For over thirty years Dr. Günther's valued assistance has always been freely given, and the present writer in particular owes him a deep debt of gratitude for his unfailing kindness and help.

All readers of the 'Annals' will join in wishing him happiness in his retirement from the multifarious duties of an arduous scientific life, of which the last to be given up was the Editorship of the 'Annals.'

W. FRANCIS.



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# CONTENTS OF NUMBER 55.—*Eighth Series.*

	Page
I. Descriptions of new Species of <i>Pyralidæ</i> of the Subfamily <i>Pyraustinæ</i> . By Sir GEORGE F. HAMPSON, Bart., F.Z.S., &c. ....	1
II. Descriptions and Records of Bees.—XLV. By T. D. A. COCKERELL, University of Colorado .....	21
III. Preliminary Descriptions of Eleven new Crinoids belonging to the Families <i>Himerometridæ</i> , <i>Mariametridæ</i> , and <i>Colobometridæ</i> , discovered by the 'Siboga' in the Dutch East Indies. By AUSTIN H. CLARK .....	31
IV. Mammals from the Ja River, Cameroons. By OLDFIELD THOMAS .....	41
V. Small Mammals from South America. By OLDFIELD THOMAS .	44
VI. Notes on Fossorial Hymenoptera.—IX. By ROWLAND E. TURNER, F.Z.S., F.E.S. ....	48
VII. Descriptions of new Harvest-men of the Family <i>Phalangodidæ</i> . By STANLEY HIRST. (Plate I.) .....	63
VIII. <i>Hersilia (Clausidium) vancouverensis</i> . By KATHLEEN HADDON. (Plate II.) .....	84
IX. Descriptions of Ethiopian Rhynchota (Heteroptera). By W. L. DISTANT .....	87
X. A Discussion of the General Classification of the Pelecypoda. By M. COLLEY MARCH, M.Sc., Geological Department, Manchester University. (Plate III.) .....	91
XI. Notes from the Gatty Marine Laboratory, St. Andrews.—No. XXXIII. By Prof. M'INTOSH, M.D., LL.D., F.R.S., &c. (Plates IV. & V.) .....	117
XII. A new Elephant Shrew from the Island of Zanzibar. By GUY DOLLMAN .....	130
XIII. On a new Palm-Civet from Timor. By ERNST SCHWARZ ..	131
XIV. On a Terrestrial Amphipod from Kew Gardens. By W. T. CALMAN, D.Sc. ....	132
XV. Descriptions of Three new African Cichlid Fishes of the Genus <i>Tilapia</i> , preserved in the British Museum. By G. A. BOULENGER, F.R.S. ....	138
XVI. Descriptions of new African Batrachians preserved in the British Museum. By G. A. BOULENGER, F.R.S. ....	140
XVII. A Revision of the <i>Asilidæ</i> of Australasia. By GERTRUDE RICARDO .....	142

## BIBLIOGRAPHICAL NOTICES.

A Revision of the <i>Ichneumonidæ</i> , based on the Collection in the British Museum (Natural History), with Descriptions of new Genera and Species. Part I. Tribes Ophionides and Metopiides. By CLAUDE MORLEY, F.Z.S., F.E.S. ....	160
Records of the Indian Museum. (A Journal of Indian Zoology.) Vol. iv. no. x. Annotated Catalogue of Oriental <i>Culicidæ</i> . Supplement. By E. BRUNETTI .....	161

## PROCEEDINGS OF LEARNED SOCIETIES.

Geological Society .....	161, 162
--------------------------	----------

## MISCELLANEOUS.

Editorial Note .....	164
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# THE ANNALS

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## MAGAZINE OF NATURAL HISTORY.

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XVIII.—*Report on the Annelida Polychæta collected in the North Sea and adjacent parts by the Scotch Fishery Board Vessel 'Goldseeker.'*—Part I. Amphinomidæ to Sigalionidæ. By WILLIAM SMALL, M.A., B.Sc., Gatty Marine Laboratory, St. Andrews.

[Plate VI.]

THE families included in the following report are Amphinomidæ, Aphroditidæ, Polynoidæ, and Sigalionidæ.

The Amphinomidæ are but sparsely represented by a single species, while the Aphroditidæ show representatives of two genera out of the three that are accounted British. The Polynoidæ are represented by nineteen species, and the Sigalionidæ by four.

The distribution of several species has been extended. *Aphrodita echidna*, de Quatrefages, and *Evarne atlantica*, M'Intosh, are recorded for the first time from the North Sea (Moray Firth), while *Euphrosyne borealis*, CErstedt, *Eucranta villosa*, Malmgren, and *Antinoë elegans*, Théel, are new to British waters, if under that term be included the Faroë Channel. Canon Norman (1890, p. 345), discussing the limits of the British Marine Area and the Report of the Committee appointed by the British Association in 1887 to define these limits (Brit. Assoc. Rep. 1888, p. 95), gives as his opinion that the fauna of the "cold area" or Faroë Channel is arctic in character, and should therefore not be

regarded as British. The British Association Committee defined the British Marine Area as consisting of a shallow-water district bounded by the 100-fathom line and a British Atlantic-slope district, or deep-water district, extending off our western and northern shores from the 100-fathom line to the 1000-fathom line, *i. e.* to the boundary of the continental plateau. This arrangement includes the "cold area" or Faroë Channel in British waters. Canon Norman's recommendation to exclude this part from the British Marine Area seems based on natural grounds. It is well known that many forms occur on the ridge between the Faroë and Shetland Islands which are not found in adjacent and deeper waters or to the south.

In the present Report, the Faroë Channel will be found to have yielded annelids, *e. g.* *Eunoa tritoni*, M'Intosh, and *Euphrosyne borealis*, CErstedt, which are not recorded from the North Sea. These forms may therefore be regarded as arctic, and, if so, should be excluded from the British marine fauna.

Lists of synonyms have not been given. They can be got from Professor M'Intosh's monograph (1900) under the heads of the various species, and they occupy a considerable amount of space.

I have to thank Prof. D'Arcy W. Thompson for his courtesy in handing over the collection for examination and for providing a list of stations. I have also had the advantage of a typical series of slides of each group from Prof. M'Intosh's collection.

### Family Amphinomidæ.

#### Subfamily EUPHROSYNINÆ.

Genus EUPHROSYNE, Savigny, 1820.

*Euphrosyne borealis*, CErstedt, 1843.

Two specimens of this form were dredged along with *Eunoa tritoni*, M'I., *Nephtys caeca*, O. F. M., and Serpulids in the Faroë Channel in 545-788 m. during the month of June. These are the sole representatives of the genus *Euphrosyne* and of the family Amphinomidæ. Their scarcity is not surprising, for these forms prefer a littoral habitat. Of the two species of *Euphrosyne* obtained by the 'Challenger' Expedition, one, *E. capensis*, Kinberg, was found between tide-marks, and the other, *E. borealis*, in 85 fathoms. The present species would appear to have a preference for deeper water.

The strikingly characteristic appearance of *E. borealis* is due to the projection of the dorsal bristles beyond the branchiæ. The latter are clearly 2- or 3-lobed, and none of them show the quadripartite condition in the mid-dorsal line mentioned by M'Intosh (1885, p. 6).

One of the specimens is mature, the body-cavity containing numerous ova. Diatoms were found in the alimentary canal.

### Family Aphroditidæ.

Genus APHRODITA, Linnæus, 1735.

*Aphrodita aculeata*, Linn., 1765.

Nine specimens of this annelid were dredged in Loch Aber at a depth of 148 m. They are small in size, the largest being little more than 30 mm. long. None of the specimens is ripe. The gut-contents consisted of diatoms, minute algæ, fragments of various minerals and of echinoderm spines, sponge-spicules, fragments of crustaceans, and bristles of other annelids.

*Aphrodita echidna*, de Quatrefages?, 1865.

One small specimen, 6 mm. long, occurred in a haul taken in 24 fathoms 3 miles west of Tarbet Ness (Moray Firth). The number of segments is only about 20.

M'Intosh (1885, p. 36) records *A. echidna* from the Strait of Magellan on two occasions. De Quatrefages (1865, p. 197) gives its habitat as South America. Treadwell (1903, p. 1157) found it in over 200 fathoms in Hawaii. The present record is the first from the North Sea, and shows the distribution of this annelid to be cosmopolitan. It has, however, yet to be recorded from the western seas of Britain.

Treadwell remarks that the ventral setæ are gradually narrowed from the base to the tip, which he notes as protruding beyond the pilose patch, as in the bristle of *Iphione spinosa*, Kinberg. In the present specimen the pilose patch projects beyond the tip of the bristle, and is itself drawn out into a fine curved point. The delicate colourless dorsal setæ described by Treadwell are not present. The dorsal felt has much débris entangled in it, but the elytra are quite free from any deposit.

A parasitic *Loxosoma* occurred on the dorsum.

Genus *LÆTMATONICE*, Kinberg, 1854.

*Lætmatonice filicornis*, Kinberg, 1865.

This species has been found on the western shores of the British Isles and on the eastern coasts of North America. It has been shown to inhabit the Faroë Channel and to extend along the coasts of Norway, and it has been recorded from Guernsey. All the localities from which the present specimens have been taken are to the north of the Shetland Islands. *L. filicornis* has therefore still to be recorded from the North Sea south of the Pentland Firth.

In no example is the number of segments more than 30. Marenzeller (1902, p. 5) gives as the number 32, "with 3 smaller ones."

The palpi are in every case much longer than the median tentacle. In no case are the palpi and median tentacle equal, as Kinberg asserted. The palpi in many cases extend to the tip of the extruded proboscis. They taper gently and regularly to a point, except for a dilated portion near the tip. They are clearly spinose, the sharp spines becoming smaller near the tip of the organ.

Many of the present examples are small, from 5 mm. upwards in length, and these have sometimes pale bristles and spines. The smallest forms were taken in May, and were probably spawned in the previous season, most likely during late autumn or winter. One specimen, taken in September, had ova.

#### Family Polynoidæ.

Genus *LEPIDONOTUS*, Leach, 1816, char. emend.

M'Intosh, 1900.

*Lepidonotus squamatus*, Linnæus, 1766.

This annelid was found in company with *Aphrodita aculeata*, *Lagisca floccosa*, Savigny, *Halosydna gelatinosa*, M. Sars, *Gattyana cirrosa*, Pallas, *Evarne impar*, Johnston, Nephthyds, Glycerids, Terebellids, *Glycinde nordmanni*, Mgrn., and other annelids at different times. It is commonly distributed around these shores, and it extends from between tide-marks to deeper water than that from which any of the present specimens have been dredged.

The average length of the specimens is 28 mm., and the segments number 25.

Professor M'Intosh (1900, p. 279) says it is probable that



the spawning-period is in June and July; yet none of the specimens captured in July are ripe, nor are there any young forms in the collection, though several examples were taken in August.

Of the other British species of this genus, *L. clava*, Montagu, no examples were found.

Genus GATTYANA (*Nychia*, Malmgren, 1865),  
M'Intosh, 1897.

*Gattyana cirrosa*, Pallas, 1766.

Fauvel points out (1911, p. 9) that the *Lepidonotus scabra* of CErstedt, which M'Intosh includes as a synonym of *Gattyana cirrosa*, is the same species as *Eunoa nodosa*, Sars—as Prof. M'Intosh said many years previously,—and should therefore be omitted from the list of synonyms of *Gattyana cirrosa* and included among those of *Eunoa nodosa*.

The total haul of the species is four specimens, the largest of which is 25 mm. long. Two of the specimens measure only 4 mm. in length, and these were taken in December and in shallower water than the other and larger specimens.

The setigerous segments are 34–36 in number. The scales are of the British type, showing none of the characteristics of the more northern forms. Their surface is covered with minute spines and the cilia are prominent.

According to Malmgren and Théel (1879, p. 7), *G. cirrosa* attains its largest development and occurs most frequently in arctic waters. M'Intosh mentions a form 47 mm. long from St. Andrews. Ditlevson (1911, p. 412, *Nychia cirrosa*) has recorded this annelid from Danmarks Havn and Stormbugt, but he gives no measurements.

Genus EUNOA, Malmgren, 1865.

*Eunoa nodosa*, Sars, 1860.

The representation of this species is very small, for only two fragments were found at Station 16 (62° N., 6° 12' W.) at a depth of 120 m. This state of affairs is only to be expected; *Eunoa nodosa* occurs off these shores only rarely and in deep water.

The fragments measure a little over 20 mm. each in length, one of them being an anterior, the other a posterior part of the annelid. Several scales are present, and these correspond to the descriptions of them. They are tough, reniform in outline, and decorated with at least nine larger tubercles, several of which are spinose at the tips.

The dorsal and ventral bristles have been fully described. Fauvel (1911, p. 8) says there is little difference in length between the dorsal and ventral bristles when allowance is made for the place of origin of the dorsal bristles, but in the present cases the ventral bristles project far enough beyond the dorsal to emphasize their greater length. The relatively shorter dorsal bristles of *Eunoa nodosa* serve to distinguish that species from *Eunoa ørstedti*, Malmgren.

Of the different anterior appendages only one of the palps is present. It shows six rows of papillæ, conical in shape and bent over at the tips, in preservation. According to M'Intosh, these papillæ become larger towards the extremity of the palp. Any increase in size in the distal papillæ as compared with the proximal is very small, and is negligible in the present specimen.

*Eunoa tritoni*, M'Intosh, 1898.

The complete specimens of this species measure 20 and 30 mm. long respectively, but several fragments indicate much larger forms. The largest fragment is 14 mm. broad with the setæ, and 25 mm. long.

The head (Pl. VI. fig. 1) is broader than long, and is deeply incised anteriorly in the middle line. The lateral eminences each end in two small peaks, and bear the large eyes, which are four in number and situated laterally. The median tentacle is absent; the lateral tentacles taper rapidly to a point, and for the proximal two-thirds of their length are covered with cilia closely resembling those of the tentacular cirri. The palps are large and are provided with rows of very small clavate or conical papillæ; they are almost twice as long as the lateral tentacles. The tentacular cirri are thickly covered with long cilia which are knobbed at the tips. There is a slight expansion of the cirrus below its filiform tip.

The dorsal markings correspond to those of *E. nodosa*, with the exception of the papillæ, which are found in *E. nodosa* internal to the scale-bearing tubercles. These are absent in *Eunoa tritoni*.

The scales are reniform in outline and have a thick fringe of cilia on the outer edge. Inside this fringe is a set of elongated tubercles divided at the tips, and along the posterior border and easily seen by the naked eye are several capstan-shaped tubercles. The latter are always more than six in number, but are never so numerous as the corresponding structures in *Eunoa nodosa*.

According to Professor M'Intosh (1900, p. 297) the cilia along the outer edge of the scale end in probe-points, the majority of which are shown in his text-figure to have pointed tips. In the present specimens the free ends of the cilia show rather a blunted or rounded condition. The surface of the scale is covered with small tubercles.

The bristles are of two types only. The dorsal setæ are long, end bluntly, and are spinous for nearly their complete length. The ventral setæ are graceful; the naked terminal region is large and hooked, and is tapered gradually until it curves to a fine point. The ventral line of this region is slightly convex, differing thus from the same part of the ventral bristle of *E. nodosa*. The bristles of the first foot partake of the same characters as the bristles of the succeeding segments, the ventral being relatively more slender.

One of the posterior dorsal cirri of one specimen has a bifid tip, which condition is no doubt an abnormality.

This species seems to be found only in deep and cold water. All records of it so far confine it to the Faroë Channel.

#### Genus LAGISCA, Malmgren, 1865.

##### *Lagisca floccosa*, Savigny, 1820.

This annelid is obtainable at all points off British shores, and in some parts is very common. In the present collection fragments are more numerous than complete specimens. Nevertheless it is easily possible to establish the fact that, of the total number of complete specimens and fragments, 60 per cent. are of the variety mentioned by M'Intosh (1900, p. 302). The characteristic serving to distinguish the variety from the normal specimen of *L. floccosa* is the condition of the tip of the dorsal bristle. Ordinarily the dorsal bristle has a sharply pointed tip; the variety shows a blunted and shortened tip. In several of the examples a form of dorsal bristle intermediate between that of the normal and that of the variety occurs. The tip of the bristle is in this case not so elongated as in the normal form or so blunted as in the variety. Its shape is quite distinct from that mentioned by M'Intosh and figured (1900, p. 302, pl. xxxviii. fig. 3) by him from a specimen obtained by the 'Porcupine' Expedition (1869-70).

It is unfortunate that none of the specimens or fragments possess a single scale. It may have been possible to correlate variation in the dorsal bristles with variation in the shape, number of tubercles, or coloration of the scales.

Among the present examples there is a considerable diversity of colour. Several forms are almost black in general appearance, while others are of a pale pink colour. These differences occur indiscriminately among normal forms and examples of the variety, and are probably due to the length of time the annelid has been in the preserving fluid (formalin).

Though it is conjectured that the breeding-season of *L. floccosa* is in the winter, none of the specimens taken in November have ova. The "parasitic granular growth" mentioned by M'Intosh is always present, especially on the dorsal bristles.

*Lagisca elisabethæ*, M'Intosh, 1900.

Of this species only one anterior fragment, 7 mm. long, occurred. It was taken in the same haul as *Eunoa nodosa*. It has hitherto been recorded only from St. Andrews.

The markings of the head described by M'Intosh (1900, p. 303) are not found in their entirety in the specimen. The pale band occurring posteriorly and defined by the collar is absent, while the median band of the same shade is indistinct. The median tentacle is of the same length as the dorsal tentacular cirrus and has a filiform tip and cilia, long and clavate, like those of the tentacular cirri. Its base is expanded and fits closely between the lateral peaked parts of the head. The palps are sparsely supplied with minute papillæ and have massive bases and elongated filiform tips. In the present specimen the tentacular cirri are relatively larger than they are shown to be in the drawing of the head of this species in Prof. M'Intosh's monograph (1900, pl. xxvii. fig. 3). The same remark applies to the tips of the cirri, lateral tentacles, and palps.

The markings on the dorsum of the fragment are indistinguishable.

When, however, the feet, cirri, and setæ are examined, there can be no hesitation in identifying the specimen as a fragment of *Lagisca elisabethæ*, M'I. The dorsal cirri have two kinds of cilia, the shorter and proximally placed, and the larger with expanded tips. The dorsal setæ occur in a mass, are pale and slightly curved, while the ventral have fairly long shafts with characteristic terminations.

The present form corresponds to the *Lagisca elisabethæ* of M'Intosh (1900, p. 303) and to the *Polynoë aspera* of Hansen, described by Théel (1879, p. 10). It differs from both in the condition of the palps. These, in the form from St. Andrews,



have "a dense series of minute papillæ with enlarged tips." The palps of Théel's more northern form are quite naked, while those of the present form, from more northern waters also, have only a few papillæ. Unfortunately no scales are present.

A larger supply of material would have made it possible to determine whether *Polynoë aspera* and *Lagisca elisabethæ* were identical. It may well be that they are the same form, for the points of difference between them are small and comparatively unimportant.

Genus ACANTHICOLEPIS, Norman, MS. (*Dasylepis*, Mgrn., 1867).

*Acanthiclepis asperrima*, Sars, 1860.

The occurrence of this annelid in the collection considerably extends its habitat. It has hitherto been found in British waters only in the Firth of Clyde; the present examples are all from the area to the north of the Shetland Islands. This uncommon annelid inhabits both our shallower waters and the deeper and colder seas of the north. It is common in the Norwegian fiords.

The complete specimens measure respectively 28 mm. and 20 mm. in length. All the scales have been lost and none of the forms has a complete set of head-appendages. Observation shows that the palps are covered for their whole length by papillæ arranged lengthwise in at least four rows. M'Intosh (1900, p. 312) remarks that the palps are only partly papillose, being mostly smooth. The papillæ are conical in shape and bent over at the tips.

The bristles, especially the ventral, are reminiscent of *Eunoa tritoni*. The animal is a striking one, and its appearance justifies its specific name.

Genus HARMOTHOË (Kinberg, 1857), char. emend. M'Intosh, 1900.

*Harmothoë imbricata*, Linn., 1767.

Of this common form only two examples were found on the same day at adjacent points in Shetland. The larger is only 20 mm. in length. It is remarkable that so ubiquitous an annelid should be so sparsely represented in the present collection.

The contents of the gut consisted of diatoms, fragments of silica and other minerals, sponge-spicules, foraminifera, spines

of small echinoderms, bristles of *Nepithys cæca*, and remnants of other annelids.

*Harmothoë antilopis*, M'Intosh, 1876.

Only two fragments, each about 13 mm. long, were obtained; one is an anterior, the other a posterior part of the annelid. This form ranges over a wide area, but always occurs in small numbers. Usually no more than a single specimen is taken in any one haul.

Identification of the fragments was not easy because of the bad state of preservation of the material. The anterior fragment is devoid of head-appendages. The posterior pair of eyes is visible from the dorsum, and the peaks of the head are rounded in front. The setæ, however, are those of *H. antilopis*, and the scales, a few of which are present on the posterior fragment, correspond to description.

Neither of the fragments has ova, though they were taken during the supposed spawning-season of the species.

*Harmothoë (Polynoë) setosissima*, Savigny, 1820.

This species seems to be an especially irritable one, for no complete specimens are present. One of the largest fragments is 33 mm. long. The species is both a littoral and a deep-water form.

Brown is the characteristic colour of the annelid, and it is found not only on the dorsum but on the tentacles &c. The dorsal cirri are also occasionally coloured brown. The close-set silky bristles give the animal a characteristic appearance.

Genus *EVARNE*, Malmgren, 1865.

*Evarne impar*, Johnstone, 1839.

The smallest examples of this species were taken in December. The complete specimens measure 8 mm. in length. None of them are ripe, though smaller examples (6 mm.) have been found with ova at the same time of the year.

Malmgren (1865, p. 71) mentions 35 as the number of segments, and St. Joseph (1888, p. 162, *Harmothoë impar*) gives 38, including the buccal and anal segments. The number seems to be very variable.

While the head agrees generally with the published descriptions of it, the peaks of the lateral eminences are more prominent, the palps are larger and taper more gradually,

the lateral tentacles have more massive bases, and the filiform tips of the cirri and tentacles are longer than shown in M'Intosh's figure of the head of *E. impar* (1900, pl. xxvii. fig. 13). The papillæ of the palps are so minute as to require a careful search. No scales are present.

All the examples are of the typical British form.

*Evarne impar*, Johnst., var.

A nearly complete specimen of 25 segments and of 16 mm. length and 6 mm. breadth from tip to tip of the setæ was taken in 35 fath. off Tod Head. It is evidently a variety of *E. impar*. It is a softer and smaller form, and shows on the dorsum none of the characteristic brown markings. The dorsum is pink in colour. The shape of the body is similar to that of *E. impar*. All the scales have been lost.

The head is slightly broader in proportion to its length than that of *E. impar*. There are no eyes. The lateral eminences are broader in front, but the peaks are the same in both forms. The median tentacle has the same massive base, brown colour, and filiform tip, though there is no apparent dilatation below the tip. In other points, as, for example, the lateral tentacles, the palps, and their papillæ, both forms agree. The tentacular cirri are absent.

Compared with the breadth of the body, the length of the bristles of the variety is less than that of the same structures in *Evarne impar*, while the dorsal bristles of the variety are larger in comparison with the ventral than in the normal specimens.

In shape the dorsal bristles (Pl. VI. fig. 2) resemble those of *Evarne kerguelensis*, M'Intosh (1885, p. 97, pl. vi. a, fig. 12), though they are less curved and less attenuated towards the tip. The tip is longer and more pointed than that of *E. impar*, but the transverse rows of spines and the lateral spines are similar. The tip is most like that of *E. kerguelensis*, or, again, it may be said to be intermediate in shape between that of *E. impar* and that of *E. atlantica*, M'Intosh.

The superior ventral bristles resemble those of *E. impar*. The median and inferior ventral bristles are more numerous and show either no secondary process or only a small trace of it, recalling thus the ventral bristle of *E. atlantica*.

Many varieties of *E. impar* have been described. The present one is probably akin to that mentioned by M'Intosh (1900, p. 357) as procured by the 'Porcupine' in 1870. Specimens without eyes have likewise been obtained.

*Evarne johnstoni*, M'Intosh, 1876.

This species has previously been obtained only from the Atlantic Ocean to the west of Ireland. The present record is the first of it from the seas to the north of the Shetlands, where it was obtained in 362 m. The haul consists of one fragment of a few anterior segments. M'Intosh gives the length of his examples as 9 mm.

The dorsum shows a distinctive deep brown colour and the proboscis is characteristically tinted. Contrary to the usual condition, it is not extruded. The body, however, is ruptured.

The eyes are moderately large and of a brown colour; only the posterior pair is visible from above.

No scales are present. The bristles are characteristic and are alone sufficient to identify the annelid.

The present example may be a variety, for the eyes are not the "minute black points" described by M'Intosh (1900, p. 359). At the same time his figure of the head of *E. johnstoni* (1900, pl. xxvii. fig. 7) shows the eyes large enough to be those of the present specimen and too large for his description of them.

*Evarne atlantica*, M'Intosh, 1897.

An anterior fragment of this annelid, which was first brought to light by the Royal Irish Academy's Expedition (1896), was taken in 24 fathoms in the Moray Firth in the same haul which yielded *Aphrodita echidna*.

Both pairs of eyes are very conspicuous from the dorsum. Brown and pink are the characteristic tints of the dorsal region. The scale-bearing tubercles and the lateral borders of the segments which do not bear scales are outlined in dark brown. Internal to these markings there are, on each segment, patches of a paler brown colour, and along the mid-dorsal line bars of dark brown on a band of pink, which passes along the whole length of the fragment, mark the posterior border of each segment. The dorsal coloration thus differs from that of the original specimen (M'Intosh, 1900, p. 363). The feet and ventral surface are pink in colour and the bristles are pale yellow.

The scales, which are unknown, cannot be described because of their complete absence. Prof. M'Intosh thinks that they approach those of *E. normani*.



## Genus ANTINOË, Kinberg, 1857.

*Antinoë sarsi*, Malmgren, 1865.

Only one anterior fragment of 6 mm. length was taken. It occurred in the same haul as *Evarne johnstoni*. Further investigation may prove some kind of a relationship to exist between the two forms. They have occurred together in different collections.

Théel (1879, p. 18) gives *Antinoë sarsi* (Kinberg), Malmgren (excluding Malmgren's "nondum adult" form from Spitsbergen), as a synonym of his *Polynoë badia*, which is, however, more likely to be the same form as *Antinoë elegans* (below).

*Antinoë elegans*, Théel, 1879.

Théel (1879, pp. 20-22, pl. i. figs. 13-16) instituted the genus *Bylgia* and the species *elegans* for one annelid procured in the Sea of Kara at a depth of 34 m. Levinsen (1883, p. 88) mentions this form (*Bylgia elegans*). No further records of it have been found.

The present examples are a single specimen from 61° 27' N., 1° 47' W., and one complete specimen and several fragments from 60° 36' N., 4° 46' W., at depths of 1240 m. and 1030 m. respectively. It is worthy of note that in both hauls *Eunoe tritoni*, M'I., was included.

Théel characterized the genus *Bylgia* thus:—"Lobus cephalicus antice in prominentias non productus. Antennæ e parte anteriore lobi cephalici productæ. Tentaculum nullum. Elytra paria 15, totum dorsum tegentia, in segmentis setigeris, 2, 4, 5, 7, 9 . . . . 23, 26, 29, 32."

Unfortunately no elytra are *in situ*, but it is easy to establish the fact that Théel's numbers of the elytra-bearing segments correspond exactly to those of the present specimens. The broadest part of the body is from the middle of its length forward to the seventh segment. The anterior segments decrease little in breadth; the posterior half of the body tapers distinctly towards the last segment. According to Théel the body is everywhere of the same breadth; that may be so in large specimens. The setigerous segments number 37.

Théel's specimen measured 59 mm. without and 74 mm. with the proboscis. The complete specimen of the present collection measures only 46 mm. in length, and none of the fragments indicate a form as large as 59 mm.

Only one of the specimens—and that a doubtful *Antinoë*

*elegans*, because of its small number of segments (16), lack of setæ, and bad preservation—shows the violet-brown colour of the dorsum, the deep violet-over-grey of the proboscis, and the violet palps mentioned in the original description. The majority of the examples are brown-coloured on the dorsum, resembling Théel's *Polynoë badia* (1879, p. 18). The ventral surface and the feet are a uniform grey-white and the bristles are golden yellow.

Théel regarded the genus *Bylgia* as diverging from other polynoids after the manner of Kinberg's family Iphionea, because of the absence of a median tentacle, but as being removed from the genus *Iphione* because of important anatomical differences. Examination of the present specimens would seem to show that Théel's *Bylgia* is very closely related to the other polynoids and that his diagnosis of the genus is a mistaken one.

The head is as broad as it is long, the greatest breadth being in front of the transverse middle line. It is divided by a median incision, which narrows posteriorly and passes backwards a little beyond the level of the anterior pair of eyes. There are thus the usual two lateral eminences, and these are pear-shaped and produced anteriorly into two very distinct peaks which are not produced forward into the antennæ. These peaks were not observed by Théel. Levinsen (1883, pp. 38, 195) has apparently not examined the annelid; at any rate, he mentions the absence of projecting peaks as a diagnostic characteristic of *Bylgia elegans*. All the present examples having heads, five in number, show the condition described above. The anterior eyes are the larger and are well removed from the front of the head and placed near its lateral border on the highest parts of the eminences. The posterior eyes are more closely set together than the anterior and are situated near the nuchal border of the head. The space between the peaks is filled with the massive rounded base of the median tentacle. This base is present in every specimen, but no example of the tentacle. Having their origin below the peaks are the two lateral tentacles. These have a strong basal portion, are conical in shape, and uniformly tapered to a point. Théel avers that their bases are partly united to form one, but in the present examples the base of the median tentacle is interposed. The palps are remarkably large—larger than Théel's drawing indicates—and are supplied with minute papillæ which escaped Théel's observation. They have no filiform prolongation of the tip. The tentacular cirri have all been lost. The head resembles

on the whole that of *Polynoë badia*; indeed, the two forms are closely united in many points.

The proboscis has nine terminal papillæ on either side—the same number and of the same shape as in *Lepidonotus*. The four teeth alternate, are sharply pointed, and have a plain biting-edge supported by a ridge.

Théel remarks that the feet and bristles of *Bylgia elegans* resemble those of *Antinoë* (*Polynoë*) *sarsi* and the dorsal bristles those of *Melenis loveni*, Malmgren. The ventral bristles are whip-like, being slender and drawn out into a long fine tip. The lower part of this bristle is decorated with spines, which are shield-shaped, point steeply upwards, and are arranged in longitudinal rows. Above these, clothing the tip of the bristle, is an investment of very fine hair-like spines, and below them, where the bristle is thickest, the spines are smaller and more closely set together. As figured by Théel, other ventral bristles are terminated in a slender and slightly bent-over tip, but none of these were observed. The transverse rows of spines of the dorsal bristles are closely set together; the tip is small and pointed, but not acutely.

The elytra are glabrous and the outer and posterior edge has minute ciliform papillæ, as in *Polynoë badia*.

It will now be apparent that Théel's diagnosis of the genus *Bylgia* is wrong, in that it supposes the absence of anterior peaks on the cephalic lobe and of a tentacle (median), and the forward production of the anterior part of the head to form the antennæ or lateral tentacles.

When all points have been considered, it seems best to refer *Bylgia elegans* to the genus *Antinoë*. The resemblances between the present form and *Antinoë* spp. are numerous and cover practically all the features of generic importance.

Théel himself remarked that, in aspect, structure of the feet, bristles, and number of scales, his *Bylgia elegans* closely resembled *Antinoë* (*Polynoë*) *sarsi*. The numbers of setigerous segments in the two forms are nearly alike; the structure of the head, disposition of the eyes and median tentacle, the condition of the palps and proboscideal papillæ correspond. The resemblance between the setæ, especially the ventral, is striking. While due consideration has been given to the opinions of different authors, *e. g.* Hansen (1882, p. 1) and Harvey Gibson (1886, p. 342), regarding the value of setal characters in specific or generic separation of forms (*cf.* McIntosh, 1874, p. 371), it is impossible from the structure of the setæ alone to place *Antinoë elegans* in any known

species of *Antinoë* or in the genus *Harmothoë* or *Polynoë* so long as *Antinoë* remains a genus apart from *Harmothoë*, however closely the former may approach the latter.

While Théel's description of *Polynoë badia* and varieties (1879, pp. 18-20) may apply to these forms, it is curious that the inferior ventral bristle which is diagnostic of *Antinoë elegans* and is figured by Théel (1879, pl. i. fig. 16) is present in every specimen. Again, a certain aspect of the superior ventral bristle resembles Théel's figure of a ventral bristle of a young specimen of *Polynoë badia*, one of whose synonyms is given by Théel as *Antinoë sarsi*.

It is most probable that Théel's *Polynoë badia* and *Bylgia elegans* are one and the same form. Again, researches into the differences in structure between young, intermediate, and adult forms may alone be conclusive.

#### Genus MALMGRENIA, M'Intosh, 1876.

##### *Malmgrenia castanea*, M'I., 1876.

Three very small fragments of this annelid were taken in the same haul as contained the fragments of *Evarne johnstoni* and *Antinoë sarsi*. *M. castanea* has been recorded from all round these shores.

The head appears to be broader in front than behind and the anterior eyes are more widely separated from each other than usual. Stress cannot be laid on these points because of the scarcity of material, but it is remarkable that the only two anterior fragments present these appearances.

#### Genus HALOSYDNA, Kinberg, 1857.

##### *Halosydna gelatinosa*, M. Sars, 1860.

The only complete specimen is a comparatively small one of 20 mm. in length. One specimen has no eyes; in another the pairs of eyes are so close together as to touch. The enlargement of the median tentacle below the filiform tip is prominent, and the same remark holds for the tentacular cirri, which are almost as long as the median tentacles. A semi-lunar membrane extends from the first body-segment forward over part of the head. The palps are massive and transversely striated.

St. Joseph (1888, p. 155) gives the number of segments of a *H. gelatinosa* as 45. The number in the present example is only 17.



A ripe specimen was taken in December. The reproductive elements are contained within a membrane, as noted by St. Joseph and represented by Claparède (1870) in *Hermadion fragile*. A ripe male occurs in a haul taken in April. The alimentary canal contains remnants of small crustaceans and other organic débris.

Genus POLYNOË, Savigny, 1820.

*Polynoë scolopendrina*, Sav., 1820.

One fragment of 12 segments was taken in 120 m. at Station 16 in the same haul as contained *Eunoe nodosa* and *Lagisca elisabethæ*.

The eyes are large and the anterior and posterior pairs are very close together. Their proximity is probably due to antero-posterior shrinkage of the head, which thus appears broader than long. The present example belongs to the smaller southern type, but is not of the variety of *brevipalpa* of St. Joseph (1888, p. 183).

More examples of *P. scolopendrina* may be found when terebellid &c. tubes are examined,

Genus EUCRANTA, Malmgren, 1865.

*Eucranta villosa*, Mgrn., 1865.

This species is represented by one fragment of 16 segments in a fair state of preservation. It was dredged at 61° 39' N., 4° 45' W., at a depth of 620 m.

It was first discovered and named by Malmgren (1865, pp. 79–80, pl. x. figs. 9–9 d). It has been recorded within recent years by Ditlevson (1911, p. 416, *Harmothoe villosa*) from 76° 35' N., 18° 26' W., at a depth of 150 m. Fauvel makes no mention of this species in his Report on the Polychæt Annelids of the Campagne Arctique de 1907 (Duc d'Orleans). The species seems to be confined to northern waters. It was obtained in Barents Sea (between Spitzbergen and Nova Zembla) by the Austro-Hungarian North Pole Expedition, 1872–1874 (Marenzeller, 1877), but the Dutch 'William Barents' Expedition of 1878–1879 failed to find it in the same locality (d'Urban, 1880, p. 253). Hansen (1882, p. 44, *Polynoë villosa*) records it from the southern limit of the "cold area" (off Christiansund) in 763 m. on a clay bottom. It was found only once in the three summers of the Norwegian Expedition, 1876–1878. It is, like *Acanthicolepis asperrima*, characteristic of the Norwegian fiords.

The head-parts are unfortunately incomplete. The relation between the length and breadth of the head in the present specimen corresponds to Malmgren's drawing. The eyes are large; the anterior pair are placed well back on the head and close to its lateral edge, and are larger than the posterior pair, which are placed laterally in front of the nuchal border of the head. The tentacles are wanting. Théel (1879, p. 23) has completed the descriptions of Malmgren and Sars (1873, p. 4) by describing the median tentacle. The one tentacular cirrus and the palps agree entirely with the published descriptions.

No scales and no dorsal cirri are present. The tubercle which, according to Malmgren, takes the place of the dorsal cirrus on the segments which do not bear scales is not apparent. The ventral cirrus is sparingly supplied with short clavate cilia.

Ditlevson, whose material consisted of a fragment of 9 segments, bases the identification of his specimen on the appearance of the bristles, and remarks that his examination of the bristles shows them to agree exactly with the description and figures of Malmgren.

The spines on the dorsal bristles of the present example are more prominent than shown by Malmgren's drawing, and the dorsal bristles themselves, especially the superior, are more curved. Malmgren's artist likewise has not given sufficient prominence to the spines of the superior and inferior ventral bristles, nor does the drawing of the inferior ventral bristle show that the spines increase in length and prominence towards the apex of the bristle.

The dorsal bristles (twelfth foot) are gracefully curved (Pl. VI. fig. 3); the spines become larger towards the tip and attain their maximum size a short distance from it. The transverse rows of spines almost pass across the complete breadth of the bristle, recalling the condition in *Evarne impar*. Indeed, the dorsal bristle of *Eucranta villosa* closely resembles that of *Evarne impar* but for the tip, which in *Eucranta* is rounded and blunt. The bristles are covered with a brown granular mass. The inferior dorsal setæ are more curved and slender and have longer spines than the superior.

The bifid condition of the tip of the superior ventral bristle (fig. 4) is not common; it occurs in *Eupolynoë occidentalis*, M'Intosh, and in *Eupolynoë anticostiensis*, M'Intosh, both of which are Canadian forms. The bristle itself is slender and tapers gracefully. The lateral spines are large and slightly recurved and are almost equalled in length by the transverse

rows of spines. The latter are also recurved. The spines decrease in number and size towards the tip, and the bifid portion of the bristle is entirely naked. This part is slightly swollen immediately below the bifurcation.

The inferior ventral bristles (fig. 5) are more massive than the superior. Their outline recalls the hastate bristles of *Aricia*. The spines are confined to the thicker lower portion of the bristle, leaving a large smooth tip the edges of which are not so straight and uniformly converging as shown by Malmgren,

Trauttsch (1889, pp. 139 & 143) gives as references to *Harmothoë villosa*, Levinsen (1883, pp. 36, 193) and Malmgren (1865, pp. 79–80), and to *Eucranta villosa*, Malmgren (1865, pp. 79–80). The references to Malmgren are identical, while Levinsen, as Trauttsch remarks, does not mention the genus *Eucranta*, but refers to what is undoubtedly the same form as *Harmothoë villosa*, and himself gives the same reference to Malmgren. Yet Trauttsch mentions the two names, *H. villosa* and *E. villosa*, in places apart in the text and in a table of dredgings as if they were distinct species. His drawing of a ventral bristle of *H. villosa* (1889, pl. vii. fig. 16) does not resemble either Malmgren's original drawing of a ventral bristle of *Eucranta villosa* or the appearance of the same in the fragment of the annelid under discussion.

### Family Sigalionidæ.

Genus *STHENELAIS*, Kinberg, 1857.

*Sthenelais boa* (Johnston, 1833), Kinberg, 1857.

One incomplete specimen of 17 mm. length was dredged from a depth of 5 fath. in Quey Firth, Shetland.

It is remarkable that the representation of this form, which ranges from Norway along the western shores of Europe to South Africa, should be so small. The specimen presents no points of difference from the typical British form except in coloration. The head is not of a crimson hue nor are the few scales present on the dorsum marked with grey or brown.

*Sthenelais zetlandica*, M'Intosh, 1876.

Two small fragments, one anterior, the other posterior, were found in Shetland waters.

The head is injured, and therefore its structure cannot be

described. M'Intosh's specimens were similarly deficient (1900, p. 414).

The palps appear to be long, slender, and tapering, like those of *Sthenelais limicola*, Ehlers. The posterior end of the annelid is slender and has apparently two caudal cirri.

An examination of the complete head will determine whether this form shall remain in the genus *Sthenelais*.

*Sthenelais limicola*, Ehlers, 1864.

One specimen was taken along with numerous examples of *Ophiodromus flexuosus*, Della Chiaje, in 56° 48' N., 1° 19' E., in 94 m. It is a deep-water form, ranging from 30 to over 400 fathoms, and is never found between tide-marks.

The body is small and incomplete. All the scales have been lost, and the head is in a bad state of preservation.

*Sthenelais jeffreysii*, M'Intosh, 1876.

Specimens of this annelid were taken from the seas to the north of the Shetland Islands. It has been recorded only from the Atlantic Ocean to the west of Ireland, and has still to be found in the North Sea. It would seem to prefer a deep-water habitat.

The largest of the specimens (incomplete) are about 35 mm. in length. The body is long and narrow, and tapers gently towards the posterior end. No eyes are visible in any of the specimens. The proboscis has ten irregularly conical terminal papillæ dorsally and ventrally.

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## EXPLANATION OF PLATE VI.

- Fig. 1. Head of *Eunoa tritoni*, M'Intosh. Enlarged.  
 Fig. 2. Tip of dorsal bristle of *Evarne impar*, Johnst., var. Zeiss obj. D, oc. 2.  
 Fig. 3. Mid dorsal bristle of *Eueranta villosa*, Mgrn. Zeiss obj. D, oc. 2.  
 Fig. 4. Superior ventral bristle of ditto. Zeiss obj. D, oc. 2.  
 Fig. 5. Inferior ventral bristle of ditto. Zeiss obj. F, oc. 2.

XIX.—*Descriptions of new Batrachians from the Andes of South America, preserved in the British Museum.* By G. A. BOULENGER, F.R.S.

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*Hyla melanopleura.*

Tongue circular, entire and slightly free behind. Vomerine teeth in two groups or short transverse series between the rather large choanæ. Head moderate, broader than long; snout short, rounded, as long as the orbit; canthus rostralis obtuse, loreal region oblique, concave; nostril equally distant from the eye and from the tip of the snout; interorbital space as broad as the upper eyelid; tympanum distinct, two-thirds the diameter of the eye. Fingers one-fourth webbed, disks smaller than the tympanum; male with a projecting rudiment of pollex; toes three-fourths webbed; subarticular tubercles moderately prominent; a feeble tarsal fold. The tibio-tarsal articulation reaches between the eye and the tip

of the snout ; tibia half the length of head and body. Skin smooth, belly and lower surface of thighs granulate. Greyish or reddish brown above, sides blackish ; the back may be spotted or dotted with brown, the sides dotted with white ; upper lip white ; limbs with irregular dark cross-bands ; lower parts dirty white, sometimes speckled with dark brown. Male with a subgular vocal sac.

From snout to vent 50 mm.

Several specimens from Huancabamba, E. Peru, above 3000 feet, from the collection of Mr. E. Boettger.

*Phyllomedusa loris.*

Tongue cordiform, slightly nicked behind. Vomerine teeth in two small groups between the choanæ. Snout as long as the orbit, vertically truncate at the end ; canthus rostralis obtuse, loreal region oblique ; eyes directed obliquely forwards ; interorbital space broader than the upper eyelid ; tympanum half the diameter of the eye. Fingers with a slight rudiment of web, first shorter than second ; toes webbed at the base, first and second equal ; disks of fingers as large as the tympanum, of toes a little smaller ; subarticular tubercles moderately prominent ; inner metatarsal tubercle small, elliptic. The tibio-tarsal articulation reaches the tip of the snout ; tibia  $\frac{4}{5}$  the length of head and body. Skin smooth, granulate on the belly and under the thighs ; parotoids feebly developed ; heel with a small triangular dermal appendage. Lilac above (in spirit) with a few dark dots ; humerus, four inner fingers, thigh, except a narrow lilac streak, inner toes, and lower parts yellow.

From snout to vent 46 mm.

A single specimen from El Topo, R. Pastaza, E. Ecuador, 4200 feet, from the collection of Mr. M. G. Palmer.

*Bufo leptoscelis.*

Crown with bony ridges, including a parietal obliquely directed inwards ; snout truncate, slightly projecting ; loreal region nearly vertical, concave ; interorbital space broader than the upper eyelid ; tympanum very distinct, three-fourths the diameter of the eye. Fingers rather long and slender, obtuse, first longer than second ; toes barely half webbed, obtuse, with single subarticular tubercles ; two small metatarsal tubercles ; no tarsal fold. Tarso-metatarsal articulation reaching far beyond the tip of the snout ; tibia half the length of head and body. Upper parts with small conical

tubercles, more crowded and spinose on the sides; parotoids very prominent, subtriangular, two-thirds the length of the head. Uniform pale brown above, the parotoids darker; yellowish beneath, belly dotted with brown.

From snout to vent 55 mm.

A single specimen from Santo Domingo, Carabaya, S.E. Peru, 6500 feet, from the collection of the late Mr. G. Ockenden.

*Hylodes ockendeni*.

Tongue oval, entire or indistinctly nicked behind. Vomerine teeth in two oblique oval groups just behind the level of the choanæ. Snout rounded, as long as the orbit, with moderately strong, curved canthus and very oblique, concave loreal region; nostril near the tip of the snout; interorbital space hardly as broad as the upper eyelid; tympanum very indistinct, not half the diameter of the eye. Fingers and toes moderate, the tips dilated into large, broad disks; first finger not extending as far as second; scarcely a rudiment of web between the toes; subarticular tubercles well developed but small; a small, oval inner metatarsal tubercle. The tibio-tarsal articulation reaches the anterior border of the eye, or between the eye and the nostril; tibia half the length of head and body. Skin smooth. Pale pinkish brown above, with small scattered black spots, with or without a large brown blotch, or three brown blotches on the back; a narrow light vertebral line may be present; a dark bar between the eyes, and an oblique black streak in front of and behind the eye; two or three oblique brown bars on the tibia; lower parts white.

From snout to vent 34 mm.

Three specimens from La Union, Rio Huacamayo, Carabaya, S.E. Peru, 2000 feet, from the collection of the late Mr. G. Ockenden.

*Hylodes ventrimarmoratus*.

Tongue large, subcircular, entire. Vomerine teeth in two oblique oval groups behind the level of the choanæ. Snout rounded, as long as the orbit, with very feeble, curved canthus and very oblique, concave loreal region; nostril near the tip of the snout; interorbital space as broad as the upper eyelid; tympanum very indistinct, not half the diameter of the eye. Fingers and toes moderate, the tips dilated into large, broad disks; first finger not extending as far as second; toes free; subarticular tubercles small, feebly

prominent; a small, oval inner metatarsal tubercle. The tibio-tarsal articulation reaches the eye; tibia half the length of head and body. Upper parts rugose with small warts, lower parts smooth. Grey above, with blackish symmetrical markings, forming a large X on the back, and a subtriangular blotch between the eyes; upper lip with dark bars radiating from the eye; limbs with dark cross-bands, the front of the thighs with black and white bars, the back of the thighs black, with or without large white spots; throat and lower surface of thighs yellowish, belly and flanks white with large black spots and marblings.

Total length 37 mm.

A single adult specimen from Chanchamayo, E. Peru, 2600 feet, from the collection of Mr. C. Schunke, and an adult and two very young from El Topo, R. Pastaza, E. Ecuador, 4200 feet, from the collection of Mr. M. G. Palmer,

*Hylodes taniatus.*

Tongue oval, nicked behind. Vomerine teeth in two oblique oval groups behind the level of the choanæ. Snout rounded, as long as orbit, with strong, nearly straight canthus and oblique, concave loreal region; nostril near the tip of the snout; interorbital space as broad as the upper eyelid; tympanum distinct, one-third the diameter of the eye. Fingers and toes rather short, the tips dilated into large, broad disks; first finger not extending as far as second; a slight rudiment of web between the toes; subarticular tubercles well developed; a small oval inner and a very small rounded outer metatarsal tubercle. The tibio-tarsal articulation reaches the tip of the snout; tibia nearly two-thirds the length of head and body. Skin smooth, the belly very indistinctly granulate. Brown above, darker on the sides; a blackish, light-edged streak on each side of the back, from the eye to above the groin, gradually converging towards its fellow; a dark brown streak, with a fine median light line, from the tip of the snout to the sacral region; a dark streak from the upper eyelid to the scapular region; a canthal streak and two bars below the eye blackish; limbs with oblique dark cross-bands, heel whitish; white beneath, throat speckled with brown.

From snout to vent 27 mm.

A single specimen from Noananoa, Rio San Juan, Choco, S.W. Colombia, from the collection of Mr. M. G. Palmer.



*Hylodes palmeri.*

Tongue oval, nicked behind. Vomerine teeth in two feeble oblique groups behind the level of the choanæ. Snout rounded, as long as orbit, with moderately strong, nearly straight canthus and oblique, concave loreal region; nostril near the tip of the snout; interorbital space as broad as the upper eyelid; tympanum distinct, one-third diameter of eye. Fingers and toes moderate, the tips dilated into large, broad disks; first finger not extending as far as second; toes quite free; subarticular tubercles well-developed but small; a small, oval inner and a very small, rounded outer metatarsal tubercle. The tibio-tarsal articulation reaches between the eye and the tip of the snout; tibia three-fifths the length of head and body. Skin smooth, belly feebly granulate. Greyish olive above, with small dark brown dots and a  $\Lambda$ -shaped dark marking on the anterior part of the back; upper lip with dark vertical bars; a dark streak below the canthus rostralis; limbs with dark cross-bands; lower parts dirty white, throat marbled with grey, belly with grey vermiculations.

Two specimens from Pueblo Rico, Choco, S.W. Colombia, 5200 feet, from the collection of Mr. M. G. Palmer.


*Hylodes margaritifer.*

Tongue oval, indistinctly nicked behind. Vomerine teeth in two small rounded groups behind the level of the choanæ. Snout truncate, very prominent, as long as orbit, with strong, curved canthus and oblique, concave loreal region; nostril near the tip of the snout; interorbital space broader than the upper eyelid; tympanum distinct, one-fourth diameter of eye. Fingers and toes moderate, the tips dilated into large disks, those of the fingers broader and truncate; first finger considerably shorter than second; toes quite free; subarticular tubercles moderate; two feebly prominent metatarsal tubercles, inner oval, outer round. The tibio-tarsal articulation reaches between the eye and the tip of the snout; tibia three-fifths the length of head and body. Skin smooth, with scattered tubercles, which are subconical on the head and back, and larger, white, pearl-like on the throat and belly; a larger, conical tubercle on the upper eyelid and another on the heel. Yellowish above and beneath, above with dark brown symmetrical markings and the tubercles crimson.

From snout to vent 15 mm.

Two specimens from El Topo, R. Pastaza, E. Ecuador, 4200 feet, from the collection of Mr. M. G. Palmer.

*Edalorhina nasuta.*

Vomerine teeth in two feeble oblique series behind the level of the choanæ. Head much depressed; snout pointed, ending in a pointed dermal appendage which is at least half as long as the eye, canthus rostralis strong; loreal region very oblique, concave; nostril nearer end of snout than eye; interorbital space as broad as the upper eyelid; tympanum very indistinct, smaller than the eye. First and second fingers equal; toes with a slight rudiment of web; sub-articular tubercles strong; two small metatarsal tubercles. The tibio-tarsal articulation reaches the shoulder or the tympanum. Upper eyelid with conical tubercles; a strong fold behind the eye, descending obliquely to the middle of the side; a curved ridge between the eyes and a -shaped one on the scapular region. Grey or pale brown above, with darker markings; a broad black band behind the eye, expanding into a large black blotch covering the side of the belly and the pubic region; lumbar region orange, with a large oval black spot; throat and middle of belly white; lower surface of limbs marbled black and white.

From snout to vent 38 mm.

Three specimens from Huancabamba, E. Peru, above 3000 feet, from the collection of Mr. E. Boettger.

*Hylaxalus chocoensis.*

Very closely allied to *H. bocagii*, Espada, but tympanum scarcely distinct and hind limbs longer, the tibio-tarsal articulation reaching the tip of the snout and the tibia measuring a little more than half the length of head and body. Blackish grey above, with a rather indistinct grey streak along each side of the back and a fine grey vertebral line; upper lip with a row of small white spots; a white spot on the upper surface of the arm, near its base; a black bar across the thigh and another across the tibia; lower parts white, with a few blackish spots or marblings.

From snout to vent 26 mm.

A single specimen from Noananoa, Rio San Juan, Choco, S.W. Colombia, about 100 feet, from the collection of Mr. M. G. Palmer.

*Hylaxalus collaris.*

Tongue entire or indistinctly nicked. Head as in *H. bocagii*, but tympanum very indistinct or quite hidden. First and second fingers equal; toes half webbed, the web produced as

a narrow fringe to the terminal disks; two metatarsal tubercles. The tibio-tarsal articulation reaches the eye; tibia half length of head and body, or less. Dark grey to blackish brown above, with more or less distinct darker symmetrical markings on the back and cross-bands on the limbs; a light streak sometimes present on the side, ending in the groin; lower parts yellowish white, with a dark brown bar across the throat, or entirely dark brown or blackish.

From snout to vent 35 mm.

Several specimens from Merida, 5200 feet, and Rio Albireggas, 11,300 feet, Venezuela, from the collection of Mr. S. Briceño.

## XX.—*New or little-known Ethiopian Hemiptera.*

By E. BERGROTH, C.M.Z.S.

THE Entomological Research Committee of the British Colonial Office having submitted to me for examination a number of Heteropterous Hemiptera sent in by the Committee's collectors from various parts of Africa, I have found among them some new or insufficiently known species, which are described or commented upon in this paper.

### Fam. Coptosomatidæ.

#### *Ceratocoris dama*, sp. n.

Late ovatus, valde convexus, niger, supra versicoloriter cæruleo- et aurichalceo- et cupreo-resplendens, maculis callosis parvis irregularibus flavis remote conspersus, capite subtus flavo, fascia intra-oculari basali intus angustata et abbreviata, excavatione antennali ac cornubus maris nigris, dimidio externo horum dense confluentes flavo-variegato, pectore cinereo, opaco, lateribus propleurarum late subnitidulis, fusco- et flavo-variegatis, vitta media angusta curvata anteriore propleurarum nitida fusca; mesosterno medio nitido, nigro, acetabulis omnibus flavis, limbo lato ventris intra spiracula extenso flavo, in segmentis quattuor mediis maculam majusculam subquadratam nigram inter spiracula et latera includente, spiraculis, linea transversa impressa pone hæc margineque ipso laterali ventris nigris, hoc ad apicem segmentorum interrupto, segmento ultimo ventrali medio flavo. Caput breve et latissimum, apici pronoti æque latum, medio declive, longitudine sua media fere triplo et dimidio latius, supra sat remote punctulatum, subtus sublæve, pro articulo primo antennarum recipiendo late excavatum, superne præter maculas parvas conspersas vitta mox intra marginem externum jugorum secundum

marginem internum cornuum maris ultra medium eorum continuata et maculis tribus transversis majusculis basalibus flavis (una inter ocellos, una utrinque extra eos) signatum, jugis lineam inter angulos anticos oculorum fictam haud attingentibus, oculis minusculis parum prominulis rufis, ocellis ab oculis quam inter se triplo longius remotis; rostro flavo-testaceo, articulo tertio basin versus et quarto apicem versus nigrescentibus, articulis duobus primis antennarum flavis, primo angulum anticum oculi attingente, secundo primo nonnihil brevior, apicem versus nigricante (ceteri articuli desunt). Pronotum medio capite medio plus quam duplo et dimidio longius et hoc quarta parte latius, longitudine sua media duabus tertiis partibus latius, apice quam ad humeros paullo angustius, sat dense punctulatum et praeterea latera versus transversim rugosum, maculis calliosis flavis quam in scutello minoribus et remotioribus, sed prope latera majoribus et magis condensatis, macula transversa irregulari apicali media et macula rotundata pone hanc etiam majoribus, margine apicali biangulato-sinuato, medio pone spatium interocellare recto, deinde usque ad angulos apicales late oblique truncato, marginibus lateralibus anticis fortius rotundatis, valde declivibus, marginibus lateralibus posticis anticis paullo longioribus, angulis basalibus rotundatis sed haud deletis, margine basali levissime sinuato. Scutellum sat dense punctulatum, ad basin maculis duabus callosis flavis majoribus prope angulos basales pronoti notatum, abdomine paullo latius, margine inferiore flavo, utrinque anguste nigro-marginato. Pectus in partibus opacis remote vermiculato-striolatum et remote minutissime nigro-punctulatum, mesosterno medio transversim strigoso. Corium, maculis callosis flavis exceptis, dense fortiter punctatum. Abdomen subtus subalutaceum, vix punctulatum, modice dense argenteo-sericeum,

Fig. 1.



pilositate o latere inspecta multo magis perspicua, spiraculis magnis, a lateribus quam a margine postico segmentorum magis remotis, suturis ventralibus latera non attingentibus. Pedes flavi, femoribus maculis parvis fuscis adspersis et apice inferius fusco-notatis, subtus molliter albo-pilosis, apicem versus sulcatis et inferius suberistatis, tibiis albo-setulosis, supra in dimidio basali infuscatis.

Long., ♂ 14 mm., cum corn. capit. 20 mm.

Mas: Caput (*vide* fig. 1) utrinque in cornu longum deplanatum



horizontale apice leviter reflexum prolongatum, his cornubus pronoto medio subæque longis, subparallelis, late distantibus, extus nonnihil pone apicem in lobum acutum triangularem reflexum dilatatis, margine interno cornuum reflexo; juga communiter triangulariter producta, apice angulum obtusiusculum formantia; scutellum apice e postico visum obtusangulariter sinuatum; operculum foveæ intralateralis segmenti sexti ventralis oblique transversum, dense brevissime fusco-tomentosum, margine ejus antico subrecto, postico rotundato; segmentum genitale ultimo ventrali medio longius, nigrum, margine labiali quinque-sinuato, sinibus tribus mediis obsolete disjunctis, subconfluentibus, margine apicali subrecto, angulis apicalibus rotundatis, appendice magna media deplanata medium segmenti attingente, flava.

SOUTHERN NIGERIA: Akwete (*J. J. Simpson*).

A species extremely remarkable by the structure of the head, which is broader and (apart from the horns) very much shorter than in the five other known species of the genus.

### Fam. Pentatomidæ.

#### *Euryaspis marshalli*, sp. n.

Dilutissime testacea, pronoto, scutello corioque albidis, supra parce irregulariter nigro-punctata, partes has nigras exhibens: capitis vittulam inferiorem anteocularem supra tuberculum antenniferum, marginem lateralem, orbitam oculorum, margines dimidii basalis tyli vittasque tres basales, mediam brevem, laterales intra ocellos currentes et hos longe superantes, antice oblique extrorsum vergentes et marginem lateralem attingentes, pronoti marginem apicalem, lineam punctatam utrinque circum areas cicatricales maculamque minuscule partem posticam harum linearum tangentem, scutelli foveam rotundam ad angulos basales maculamque irregularem anteapicalem, segmentorum connexivi fasciam latam basalem angulosque imos apicales, segmentorum ventris maculas majusculam ad angulos basales et minutam ad angulos apicales spiraculaque cum annulo ea cingente; pronotum inter angulos laterales maculis quinque diffusis subconfluentibus sæpe minus distinctis in seriem transversam ordinatis notatum; segmenta dorsi abdominis medio late ferrugineo-vel fusco-fasciata; segmentum genitale maris medio et lobi genitalis basales lateralesque feminae fusco-maculata; rostrum et antenne testacea, annulo harum angusto apicali articuli primi secundique, annulo angusto basali articuli secundi tertii, dimidio apicali articuli tertii, parte plus quam dimidia apicali articuli quarti parteque lata media articuli quinti nigris; pedes testacei, apice tarsorum fusco; membrana et alæ vitrea. Caput subæque longum ac latum (♂) aut longitudine paullo latius (♀), ante sinum anteocularem profundum parallelum, apice late rotundatum, oculis

magnis, eminentibus, vertice oculo uno circiter duplo latiore, rostro basin segmenti tertii ventris subattingente, articulo secundo tertio brevior, antennis crassiusculis, articulo secundo tertio multo brevior, hoc et quarto æque longis, quinto quarto paullo longiore. Pronotum lateribus rectum (♂) vel levissime subrotundatum (♀). Scutellum corio paullo longius, punctura ante medium prope latera in maculam oblongam sæpe coacervata. Pleuræ parce irregulariter nigro-punctulatæ, area evaporativa metapleuræ in mesopleuram late usque ad angulum ejus lateralem anticum extensa. Corium margine apicali leniter rotundatum, punctura ad angulum apicalem plus minusve confluenta. Connexivum crebre concoloriter punctulatum, angulis apicalibus segmentorum leniter prominulis. Venter medio lævi excepto parce subtiliter concoloriter punctulatus, segmento genitali maris apice arcuato-sinuato.

Long., ♂ 9 mm., ♀ 11 mm.

#### NYASALAND (*Dr. B. Davey*).

A strikingly distinct species, more allied to *E. signoreti*, Stål, from Senegal, than to any other described form.

Named after Mr. Guy A. K. Marshall, whose five years' investigations of mimicry and warning colours in South-African insects (Trans. Ent. Soc. Lond. 1902, pp. 287-584, with 15 plates) have so considerably increased our knowledge of this subject.

#### Fam. Coreidæ.

##### *Plectropoda cruciata*, Dall.

#### UGANDA (*C. C. Gowdey*).

The East-African specimens differ from the typical West-African form in being darker, with the corium and clavus uniformly fuscous; the structural characters are identical.

#### Fam. Pyrrhocoridæ.

##### *Cenæus gowdeyi*, sp. n.

Oblongo-ovalis, rufescens-testaceus, capite, margine laterali prothoracis epipleuraque corii rufis, margine basali superiore capitis, impressione fere tota aream elevatam pronoti circumscribente (solum lateribus postice breviter rufo-interrupta), limbo basali scutelli, vitta lata brevi basali clavi pectoreque nigris, membrana sordide rufo-testacea, abdomine fulvo, bucculis, margine apicali pronoti et prosterni inter oculos, limbo postico pleuraram acetabulisque eburneis, pedibus fuscis, femoribus (basi excepta) rufis. Caput vertice alutaceum et ibidem linea impressa longitudinali præditum, rostro fusco, medium segmenti secundi ventris attingente, articulo primo antennarum fusco, capite paullo longiore,

apicem versus incrassato, prope basin intus breviter setuloso, secundo primo distincte brevior, nigro (articuli ultimi desunt). Corium et clavus fusco-punctulato, punctis partis basalis exocorii in vittam angustam congestis, limbo externo corii rufo-punctato. Femora antica subtus in margine anteriore dimidii apicalis denticulis duobus armata.

Long., ♀, 12 mm.

UGANDA: Masaka (C. C. Gowdey).

Allied to *C. carnifex*, Fabr., but much larger and differently coloured.

### Fam. Myodochidæ.

#### *Lethæus simpsoni*, sp. n.

Oblongus, angustus, subnitidus, niger, vena cubitali corii post medium macula minuta oblongula subcallosa lutea et vena radiali nonnihil ante apicem maculis talibus duabus minus distinctis notatis, membrana fusca, venis pallescentibus, antennis, rostro pedibusque piceis, tibiis et tarsis obscure sordide testaceis. Caput paullo transversum, crebre minute punctulatum, margine basali læve, rostro coxas posticas subattingente, articulo primo antennarum plus quam dimidio apicem capitis superante, secundo primo sesqui longiore, tertio primo parum longiore (art. quartus deest). Pronotum longitudine tertia parte latius, latitudine apicali dimidio longius et apice quam basi duplo angustius, usque ad margines laterales haud explanatos ante medium leviter rotundatos transversim nonnihil convexum, sat fortiter haud dense punctatum, ante medium area transversa lævi medio punctis longitudinaliter interrupta præditum. Scutellum et pleuræ sat dense punctata. Hemelytra apicem abdominis attingentia, clavo regulariter triseriatim percurrenter punctato, corio modice dense punctulato, vena transversa venas tres exteriores membranæ conjungente interdum incompleta. Abdomen subtus haud nisi quam subtilissime punctulatum. Femora antica inermia. Articulus primus tarsorum posticorum duobus ultimis unitis vix magis quam dimidio longior.

Long., ♂, 6 mm.

SOUTHERN NIGERIA: Badagri (J. J. Simpson).

A narrow species, very distinct in several characters from the hitherto known African forms.

### Fam. Reduviidæ.

#### Subfam. ZELINÆ.

#### *Rhinocoris nitidulus*, Fabr.

A specimen from Uganda, found by Mr. Gowdey, differs

from the typical West-African form by having the middle and hind femora broadly annulated with red immediately before the apex. It shows no structural differences.

*Rhinocoris neavei*, sp. n.

Ochreo-testaceus, corio ferrugineo-testaceo, pedibus rufo-castaneis, capite cum antennis rostroque, lobo antico marginibusque laterali-bus posticis pronoti, scutello, macula denudata propleuræ et mesopleuræ, fascia basali segmentorum connexivi supra et subtus, suturis et macula transversa denudata intralaterali segmentorum ventris, coxis, annulo lato medio femorum, tibiis apicem versus, tarsis, segmento genitali feminæ maculaque oblonga laterali segmenti genitalis maris nigris, parte anteculari superiore capitis, pronoto, medio scutelli, pectore (densissime), ventre (limbo laterali excepto) corioque ochreo-sericeis. Caput erecte albo-pilosum, gula præterea dense minute albo-squamulosa; rostro glabro, articulo primo secundo paullo brevior, articulo primo antennarum pronoto paullo longior, secundo primo triplo brevior. Pronotum læve, angulis apicalibus oblique truncatis, lateralibus leviter prominulis, late rotundatis, lobo antico postice alte subconice bituberculato, pube sericea antice densissima, medio in vittas fasciasque congesta, postice deficiente, pube lobi postici minus densa. Hemelytra apicem abdominis leviter (♀) aut sat longe (♂) superantia, membrana fusco-ænea. Segmentum genitale maris apice medio in lobulum nigricantem obtusum sed lateribus acute denticulatum productum, stylis genitalibus gracilibus, apicem versus haud incrassatis.

Long., ♂ 17.5–19 mm., ♀ 22 mm.

NYASALAND: Lower Shire Valley, near Chikawa, 600 feet, and N.W. shore of Lake Nyasa, between Florence Bay and Karonga, 1650 feet (*S. A. Neave*).

Allied to *Rh. erythrocnemis*, Germ., but larger and quite differently coloured on the under side, with more elevated tubercles on the anterior pronotal lobe and the male genital segment differently constructed. The colour is quite constant.

*Phonolibes tricolor*, sp. n.

Ruber, lurido-testaceo-tomentosus, antennis (basi excepta), rostro, lobo antico pronoti, scutello, pectore (excepta parte posteriore propleuræ), maculis duabus transversis apicalibus late distantibus segmentorum ventris (sexto excepto), segmento genitali pedibusque nigris, membrana cærulea. Antennæ validiusculæ, articulo primo capite paullulo brevior, secundo primo angustior et triplo brevior, tertio incrassato (saltem in mare), primo tertia parte brevior. Pronotum fortius convexo-declive, lobo postico antico triplo longior, medio longitudinaliter anguste canaliculato.



Hemelytra apicem abdominis paullum superantia, corio (limbo laterali excepto) dense et crasse reticulato.

Long., ♂, 16 mm.

UGANDA: Sunga Masaka (C. C. Gowdey).

A large species, easily recognized from all others.

*Phonolibes bimaculatus*, Dist.

Distant has omitted the principal character of this species: the non-reticulated corium, which has a single oblique transverse vein in the mesocorium. The antennæ are broken in the female specimen before me; in the male the third joint is incrassated (as in *Ph. tricolor*, Bergr.), and I suppose that this is a secondary male sexual character.

Of this species I have also seen a brachypterous specimen in which the hemelytra are convergent, only twice the length of the scutellum, and with the membrane quite rudimentary.

NYASALAND: between Mlanji and Zomba, 2000–3000 feet (S. A. Neave); N.E. RHODESIA: Fort Jameson, 3800 feet (S. A. Neave).

Subfam. *REDUVIINÆ*.

*Edocla præcox*, sp. n.

*Forma aptera*: Nigra, parce anguste albo-squamulosa, apice spinæ lateralis lobi postici pronoti spinæque scutellaris, macula transversa laterali-apicali segmentorum connexivi supra et subtus maculisque dorsi abdominis in series duas approximatas longitudinales ordinatis luteis, squamulis dorsi abdominis hic et illic, præsertim in segmento secundo, densioribus et aurescentibus, capite et thorace granulatis. Caput ante oculos fortiter declive, jugis inter antennis in processus duos contiguos apice brevissime liberos porrectis, ocellis nullis, articulo primo antennarum parti postoculari capitis cum oculo subæque longo, secundo primo fere duplo longiore, sæpe pallescente, rostro parce breviter albo-setuloso. Pronotum abdomine plus quam duplo angustius, angulis apicalibus rotundatis, lobo antico valde convexo, inermi sed præsertim postice fortiter sculpto, lobo postico antico multo brevior et humiliore sed paullulo latiore, spinis duabus discoidalibus et utrinque spina laterali oblique sursum et paullo retrorsum directa armato. Scutellum apice spina valida suberecta apice recurva armatum. Rudimenta hemelytrorum basin abdominis attingentia, subtriangularia, apice truncata. Abdomen late ovale, segmentis ventralibus latera versus concretis, secundo basin versus carinato, sexto (♀) medio duobus præcedentibus unitis longiore, medio transversim plicato-elevato, segmentis

genitalibus nigro-setulosis. Pedes picei, fossa spongiosa tibiæ anteriorum minus quam trientem apicalem occupante.

Long., ♀, 11·5–13 mm.

Forma alata ignota.

NYASALAND: S.E. shore of Lake Nyasa, between Fort Maguire and Fort Johnston (*S. A. Neave*); N.E. RHODESIA: between Fort Jameson and Lundazi, 4000 feet (*S. A. Neave*).

Allied to *E. bisbisignata*, Stål, but smaller and differently coloured, with the first antennal joint shorter.

### *Edocla pilosula*, Dist.

Abdomen ad angulos apicales segmentorum, ultimo excepto, spina armatum, his spinis in segmento primo validis, in segmentis sequentibus longitudine sensim decreascentibus.

*Forma aptera* (♀): Lobus posticus pronoti antico duplo brevior et multo humilior. Mesonotum lateribus spinula erecta parva, metanotum ibidem spinula erecta majore armatum. Hemelytra et alæ nulla.

Long. 6–7 mm.

NYASALAND: Lower Shire Valley, near Chikawa, 600 feet (*S. A. Neave*).

Distant has omitted the principal character of the species, the spinous abdominal margin, by which it differs from all other species of the genus. Mr. Champion has kindly examined the type, and informs me that the abdomen is spinous also in the winged form.

### Subfam. PETALOCHIRINÆ.

#### *Petalochirus pugil*, sp. n.

Elongato-ovatus, parce pilosus, capite superiore, pronoto scutelloque ochraceis, hemelytris fuscis, connexivo fusco-nigro, capitis maculis duabus oblongis anterioribus postice confluentibus, impressione transversa interoculari, vitta retrorsum angustata inter ocellos et basin lateribusque postocularibus, pronoti vitta media antice abbreviata sublateralique subcurvata lobi antici ac vitta media angusta antice abbreviata, maculis quattuor antemedianis (exterioribus minoribus) basique anteriore spinæ lateralis lobi postici, scutelli disco spinaque laterali nigris, maculis numerosis hemelytrorum squalide albidis, macula transversa obliqua apicem mesocorii occupante fuliginosa, fascia vel macula transversa prope basin segmentorum connexivi (in segmentis duobus ultimis feminae solum ad marginem lateralem distinctis) fulva, maculis duabus denudatis horum segmentorum, altera ante, altera mox pone medium sita, nigris, spinis angulorum apicalium segmentorum piceis, apice late pallide flavidis; subtus cum rostro

niger, præter pilos suberectos pubescentia adpressa auro-sericea haud densa præsertim latera versus indutus, bucculis, spinis prosternalibus, vittis tribus anterioribus (externis postice plerumque conjunctis) et macula postica mesopleurarum, vitta sublaterali metapleurarum, limbo acetabulorum omnium, vitta angusta (♂) vel latiuscula irregulari e maculis composita (♀) ventris, maculis oblongis lateralibus hujus prope basin segmentorum positiss spiraculisque ochraceis; antennæ et pedes testacea vel fusco-testacea, articulo secundo illarum apice nigro, coxis nigris, apice cum trochanteribus ochraceis, tibiis anticis fusco- et testaceo-variegatis. Caput inerme, tylo basi inter antennas latiuscule tumido, sed haud carinato-elevato, oculis fortiter prominulis, sed magnitudine mediocribus, spatio interoculari superiore oculo fere duplo latiore, spatio inter bucculas et oculos diametro horum maximo (e latere viso) subæque longo, rostro piloso, articulo primo antennarum capite nonnihil longiore, secundo primo  $\frac{3}{4}$  longiore. Pronotum linea longitudinali media impressa præditum, lobo antico inermi, utrinque carinis tribus obtusis obliquis instructo, angulis apicalibus extus levissime obtuse prominulis, angulis lateralibus lobi postici spina valida acuta sursum et extrorsum directa armatis. Scutellum paullo pone medium laterum spina brevi vel tuberculo spiniformi et apice spina longa suberecta leviter curvata armatum, postscutello etiam in spinam semierectam producto. Metasternum e margine postico paullo ultra medium levissime carinatum. Hemelytra basin (♀) vel medium (♂) segmenti ultimi dorsalis paulum superantia. Abdomen ad angulos apicales segmentorum, ultimo excepto, spina semierecta armatum, ventre transversim strigoso, inter spiracula et marginem lateralem carina instructum, hac carina pone segmentum tertium vel quartum evanescente, sutura inter segmenta duo prima crenato-carinulata. Pedes breviusculi, femoribus anticis apicem capitiss vix attingentibus, in dimidio basali paullo latioribus, basin versus leviter curvatis, fovea apicali superiore pro tarsis recipiendis tibiæ anticarum lata, longitudine sua solum duplo angustiore, fossa spongiosa tibiæ anticarum lata, tarsis duplo brevioribus, femoribus posticis medium segmenti quinti (♀) vel basin segmenti sexti (♂) ventris attingentibus.

Long., ♂ 13 mm., ♀ 17.5 mm.

Mas: tibiæ anticæ intus modice, extus fortius rotundato-dilatatæ; venter medio per segmenta quinque prima carinatus; segmentum genitale primum elongato-triangularè, medium secundi haud attingens; styli genitales depressiusculi, nigri, apicem versus sensim angustati.

Femina: tibiæ anticæ intus modice, extus valde rotundato-dilatatæ, parte dilatata inferiore apicem versus sensim fortius angustata; venter medio per segmenta duo prima carinatus.

NYASALAND: Chiromo, 400 feet, and Ruvo Valley, 1000-2000 feet (S. A. Neave).

Very similar and closely allied to *P. vittiventris*, Bergr.,

but the head and pronotum are differently coloured and scarcely sericeous, the base of the tylus between the antennæ is broader, not carinate, the eyes are smaller, the anterior pronotal lobe is much more distinctly sculptured, the posterior lobe less depressed, the metasternum is more shortly and less distinctly carinate, the legs are shorter and not annulated, the fore femora broader in their basal half, the fore tibiæ much more dilated, particularly on the inner side, and the dilated part is differently shaped, their superior apical fovea (for the reception of the tarsi) is much broader, their spongy pit shorter and broader, the female venter is carinated only on the two basal segments, the first male genital segment is much more elongate, and the male genital styles are black.

In *P. vittiventris* the upper interocular space is only one-third broader than an eye, the distance between the eyes and the bucculæ is distinctly shorter than the greatest diameter of the eye (seen from the side); the two denudated spots of the connexival segments are more or less pale, and therefore much less conspicuous than in *pugil*; the fore femora pass the apex of the head by one-third their length or more, and are not or scarcely broader in their basal half; the upper apical impression of the fore tibiæ is very narrow, their spongy pit narrow and only one-third shorter than the tarsi; the hind femora reach the apex of the abdomen; the venter is carinated in both sexes from its base to the apex of the fifth segment; the first male genital segment is equilaterally subtriangular, and the genital styles are luteous.

*P. vittiventris*, Bergr., and *pugil*, Bergr., form a distinct section of the genus, intermediate in a way between the typical *Petalochiri* and the subgenus *Platychiria*, H.-Sch.

### *Tragelaphodes bergrothi*, Bredd.

Mas: segmentum ultimum dorsale abdominis penultimo duplo et dimidio longius, basi quam apice fere quinquies latius, marginibus lateralibus rectis, apicem versus sinuatis, spinis apicalibus longiusculis, retrorsum porrectis; segmentum genitale e supero visum ultra latera segmenti dorsalis ultimi late prominens, duplicatum, primo supra partem intermediam secundi usque ad medium ejus rotundato-producto, secundo apice medio subrecto, solum latera versus leviter rotundato, stylis genitalibus oblongo-triangularibus, apice late truncatis et per totam latitudinem contiguis.

Femina: segmentum ultimum dorsale abdominis penultimo subæque longum, basi quam apice late truncato duplo latius, marginibus lateralibus leviter rotundatis, spinis apicalibus brevibus.



NYASALAND: S.E. shore of Lake Nyasa, between Fort Maguire and Fort Johnston; Chiromo, 400 feet; between Fort Mangoche and Chikala Boma, about 4000 feet (*S. A. Neave*).

This species was originally described from a single specimen from Dar-es-Salaam.

The two known species of the curious genus *Tragelaphodes*, Bergr., are possibly always apterous; at least, no winged specimen has yet turned up.

### Fam. Nabidæ.

#### *Reduviolus coriixipennis*, sp. n.

Oblongus, testaceus, capite subtus et lateribus vittaque ejus lata superiore ac vitta lata postice angustata scutelli nigris, parte superiore anteantennali capitis, pronoto, hemelytris, pectore abdomineque fusco-variegatis. Caput breviuscule testaceo-pilosum, pilis paucis longis erectis intermixtis, rostro et antennis etiam pilosulis, articulo primo harum spatio inter basin ejus et ocellum subæque longo, infuscato, mox ante apicem nigrum annulo testaceo signato, articulo secundo primo circiter dimidio longiore, capiti et etiam pronoto sine collari æque longo, testaceo, mox ante apicem annulo nigro notato, articulis duobus ultimis infuscatis, tertio secundo subæque longo, basi et apice testaceo, quarto tertio paullo brevior. Pronotum (formæ macroptera) longitudine saltem quinta parte latius, breviter erecte pilosulum, vitta angusta percurrente fusca notatum, collari præterea utrinque vittis duabus fuscis signato, lobo antico lateribus fusco-nigro, disco ejus medio infuscato vel lituris obliquis fuscis plus minusve confluentibus notato, lobo postico fere horizontali, concoloriter punctato, maculis fuscis transversim quadrisubseriatis signato. Scutellum parce erecte pilosum. Mesosternum medio nigrum. Acetabula posteriora subimpicta. Sulcus orificialis oblique retrorsum directus, leniter curvatus. Area evaporativa metapleuram totam occupans, margine antico et postico hujus parallelis. Hemelytra apicem abdominis aliquantum superantia, corio et clavo fasciis numerosis fuscis signatis, subadpresse testaceo-pilosis, margine costali corii basin versus densius et longius fimbriato; membrana testacea, venis fuscis prædita et inter has præsertim basin versus dense confluentibus fusco-variegata, cellulis tribus basalibus basi late confluentibus, venis duabus eas separantibus nempe ante medium cellularum subito abruptis. Alæ apicem abdominis paullum superantes, cinereo-infumatae. Abdomen pronoto paullulo latius, subtus testaceo-sericeum, segmentis connexivi postice fuscis, margine eorum laterali pone medium nigro, ventre fusco, margine laterali (angulis apicalibus segmentorum exceptis), spiraculis vittisque duabus angustis irregularibus utrinque intra hæc testaceis, maculis denudatis nigris

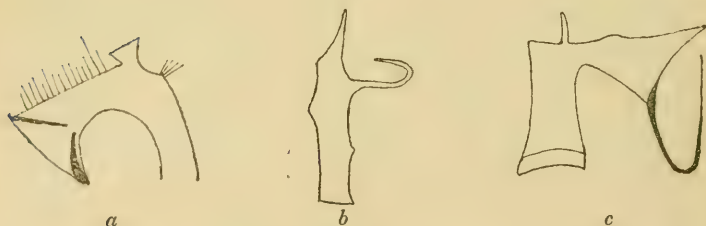
intralateralibus in segmento primo et tribus ultimis utrinque una, in segmentis secundo et tertio utrinque tribus, quarum duabus ad marginem basalem sitis, macula segmenti sexti longe pone medium ad ipsum marginem lateralem posita, segmento primo ad latera segmento secundo et metapleuræ subæque longo (hamo copulatorio maris infra delineato). Pedes testacei, pilosi, femoribus annulis compluribus fuscis interdum interruptis cinctis, anticis pronoto paullulo longioribus et latitudine sua subbasali fero quadruplo longioribus, tibiis anterioribus annulis tribus fuscis (paullulo pone basin, medio apiceque) notatis, lenissime curvatis, subtus minute spinulosis, tibiis posticis paullulo pone basin et apice annulo fusconigro et inter hos annulis compluribus dilute fuscis ornatis, apice articulorum tarsorum omnium fusco, articulis duobus ultimis tarsorum posticorum æque longis.

Long., ♂ 8-8.5 mm., ♀ 9 mm.; cum hemelytr., ♂ 9-9.5 mm., ♀ 10 mm.

NYASALAND: between Mlanji and Zomba, 2000-3000 feet (S. A. Neave).

Belongs to the subgenus *Aptus*, and is allied to *R. hottentottus*, Reut., but it is scarcely "oblongo-ovatus"; the pronotum is broader, its posterior lobe almost horizontal, not "convexo-declivis," and without the sublateral fuscous

Fig. 2.



Left copulatory hook of *Reduviolus corixipennis*, Bergr., seen from the outside (a), from below (b), and obliquely from the inside (c).

vitta; the hemelytra are considerably longer and the legs differently coloured, with the second joint of the hind tarsi longer; there are also some colour-differences in the antennæ and other parts of the body. The markings of the hemelytra remind one of the genus *Corixa*.

To this species belong the specimens recorded from Kilimandjaro by Poppius (in Sjöstedt, Kiliman.-Meru Exp. xii. p. 59) under the name *R. hottentottus*, Reut.

N.B.—The copulatory hooks of the male give very good specific characters in this genus, and many of them have been figured by Reuter in various papers and by Champion in the 'Biologia Centrali-Americana.' They are often fairly well visible from the side of the abdomen; but in some species, as in the above-described *corixipennis*, they are of a rather complicated structure and must be detached from the body (which can be easily done without injuring the abdomen) and examined from different sides.

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XXI.—*Lygistorrhina urichi*, a new *Mycetophilid* from Trinidad. By F. W. EDWARDS, B.A., F.E.S.

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THE writer has received for examination from Mr. H. Scott, of Cambridge, a small series of a very peculiar and interesting *Mycetophilid*, described below. The species is undoubtedly congeneric with Williston's *Proboleus singularis* from St. Vincent, but, for reasons which will appear, the writer does not consider that *Proboleus* can be retained as a distinct genus from Skuse's *Lygistorrhina*. The latter was described (in the female sex only) as possessing three ocelli, the median one being minute. In *Proboleus* (described from males only) the ocelli were described as apparently absent, the remaining characters of *P. singularis* being almost exactly like those of *L. insignis*. Fortunately in Mr. Scott's series both sexes are represented, and a careful examination showed that while in the male ocelli seem to be absent, in the female a pair of large ones is present in the same position as in *Lygistorrhina*. The loss of the ocelli in the male is no doubt due to the much greater development of the eyes, which are quite twice the size of those of the female. The chief (supposed) distinction between these two genera is thus proved to be non-existent, and *Proboleus* therefore becomes a synonym of *Lygistorrhina*. There are, however, some slight differences which can hardly be considered of generic value: (1) In *L. urichi* the median ocellus is apparently wanting; (2) in the two West-Indian species the mediastinal vein (*sc*) reaches the costa, while in the Australian *L. insignis* it does not; (3) *Lygistorrhina* has two small spurs to the middle tibiae, *Proboleus* only one.

*Lygistorrhina urichi*\*, sp. n.

♂. *Head* (including antennæ) black, antennæ scarcely longer than head; proboscis brownish. *Thorax* uniformly shining black. *Abdomen* very long and thin, swollen apically; black, with well-marked yellow apical bands on the first five segments. *Legs*: front coxæ with the base fuscous, the apex and trochanters yellowish; mid and hind coxæ and trochanters shining black; fore and mid femora and tibiæ yellowish; hind femora swollen, yellow, with the apical two-fifths black; hind tibiæ yellow, apical fifth black, swollen on the apical half, a close-set row of stiff hairs along the whole of the upper surface; fore and mid tarsi brownish black, hind tarsi black, appearing thickened through being clothed with short very dense hair. *Wings* almost hyaline; a distinct brown blotch at the apex, darker in colour towards the costa; venation exactly as figured by Williston for *P. singularis*. *Halteres* yellow.

Length 5–6 mm.

♀. Resembles the male, but the eyes are much smaller and the front much broader; abdomen much shorter and rather stouter, and the yellow bands less distinct; apical half or rather more of hind femora brownish black.

Length 3·5 mm.

*Hab.* Trinidad. "Swept by F. W. Urich and Hugh Scott from grass, bushes, &c., on either side of a small stream below a waterfall at Diego Martin, 22. iii. 1912, between 8 and 10.30 A.M. The day was sunny, but the flies were swept from shady places." (Note by H. Scott.) Number of specimens, 7 ♂, 1 ♀.

*Type* presented to the British Museum by Mr. H. Scott.

XXII.—A new *Vespertilionine* Bat from Angola.

By OLDFIELD THOMAS.

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A FEW years ago, by the kindness of the authorities of the Lisbon Museum, the British Museum obtained an example of a peculiar *Vespertilionine* bat which had been received from Angola, and whose systematic position seemed by no means readily determinable.

\* Named, by request of Mr. Scott, in honour of F. W. Urich, Government Entomologist in Trinidad.



I have now been able to make a careful study of this specimen, and have come to the conclusion that it represents a new genus, which may be called

CISTUGO, gen. nov. (*Vespertilionidæ*).

Allied to *Myotis*, but with differently proportioned teeth and with glands in the wings.

Skull essentially as in *Myotis*, but the brain-case not specially vaulted and the muzzle rather less pinched in laterally.

Dental formula as in *Myotis*.

Incisors of the same essential structure as in *Myotis*, but shorter. Canines similar. Small premolars subequal, minute, not half as large as the incisors, short, stumpy, quite without the similarity to a minute canine shown at least by the anterior one in *Myotis*, their tips barely rising to the level of the cingulum of the canine, the two closely pressed together and just filling the space between the canine and the large premolar. Large premolar with an unusually well-developed antero-internal cusp, as high as the large inner cusp of the molars. Lower incisors as in *Myotis*; canines proportionally short, barely rising as high as the posterior premolar; premolars all with their antero-posterior less than their transverse diameter, the two small ones closely crowded together between the canine and posterior premolar.

General external characters as in the smaller species of *Myotis*. Tragus of medium length, differing from that of most species of *Myotis* by being broader slightly above its base than at the base, its inner and outer edges both slightly convex.

Wings with peculiar thickened glands in them on the outer side of the forearms distally; three present on the left side and two on the right in the single specimen, but the situation of the third one is perceptible in the right wing, so that the normal number is probably three; the glands themselves about 3-3.5 mm. in length by 1-1.5 in breadth, more sharply outlined than the corresponding glands in *Pizonyx*; also situated closer to the forearm than in that genus, less in the centre of the wing.

Type:—

*Cistugo seabraë*, sp. n.

General appearance that of a *Pipistrellus*, say *P. kuhlii*, to which there is a considerable resemblance in size and colour. Ears of average size, their anterior margin convex at base, then nearly straight to the tip, which is narrowly

rounded; outer edge angularly concave above, convex below. Tragus pointed, its inner and outer edges both slightly convex, a rounded lobe at its outer base. Wings from the base of the toes. No post-calcareal lobule. Tip of tail projecting. General colour dull drab, the bases of the hairs everywhere slaty, the tips above drab, below whitish. Membranes brown, with whitish edges, the light-coloured reticulations conspicuous.

Skull and teeth as described above.

Dimensions of the type (measured on the spirit-specimen):—

Forearm 32.5 mm.

Head and body 40 mm.; tail 40; ear 12; tragus on inner edge 5; third finger, metacarpal 31.5, first phalanx 10.7, second phalanx 9.7; lower leg and foot (c. u.) 18.2.

Skull: greatest length 13.2; basi-sinual length 10.1; breadth of brain-case 6.6; front of canine to back of  $m^3$  4.6.

*Hab.* Mossamedes.

*Type.* Adult female. B.M. no. 6. 1. 3. 3. Presented by the Lisbon Museum.

This interesting little bat, which I have named in honour of Senhor A. F. de Seabra, C.M.Z.S., of the Lisbon Museum, is distinguishable from *Myotis* by the presence of glands in its wings, by the reduced proportions of its anterior premolars, and the large antero-internal cusp on  $p^4$ . Its general appearance is rather that of a *Pipistrellus* than a *Myotis*.

### XXIII.—On a Species of *Nymphon* from the North Pacific.

By FLORA M. SCOTT, M.A., University College, Dundee.

[Plate VII.]

THE genus *Nymphon*, and indeed all the Nymphonidæ, are of rare occurrence in the Pacific. The total number of Pycnogonida recorded there is not yet very large, and the *Nymphons* included are relatively very few. From the South Pacific two deep-water forms were brought home by the 'Challenger,' viz. *Nymphon longicollum*, Hoek, and *Nymphon procerum*, Hoek. Ortmann describes one well-defined species, *Nymphon japonicum*, from Japan; and from the China Sea a more doubtful one, *Nymphon longiceps*, has been described by Grube. Two are recorded from Australia—*N. longicoxa*, Hoek, and *N. æquidigitatum*, Haswell. If we then exclude those found from the Straits of Magellan south-

wards, which are, more strictly speaking, Antarctic or Subantarctic, the species of *Nymphon* from the Pacific are six in number.

It is therefore of interest that another should be added to this short list; more especially as it comes from a region—the west coast of North America—where, though many genera of Pycnogonida have been found, no single *Nymphon* has been recorded.

*Nymphon pixellæ*, sp. n. (Pl. VII.)

About ten specimens were collected by Miss H. L. M. Pixell, B.Sc., at Departure Bay, Vancouver Island, in the summer of 1911. In life, its colour is salmon-pink.

The *body* is slender, with well-developed, widely separate, lateral processes. Segmentation is distinct, and from the middle of each segment springs the lateral process (fig. 1).

The *head* and proboscis are equal in length to trunk. The *neck* is slender, cylindrical, expanded in front and marked by a slight median groove. The *ocular tubercle* (figs. 2 & 3) is very high and conical, slightly depressed anteriorly, directed slightly backwards; near the base are four well-developed lenses. Beneath it ventrally on neck are developed body-processes from which the ovigerous legs arise (fig. 6).

The *proboscis* is cylindrical and very slightly shorter than the cephalic segment. Distinctly articulated with the last body-segment and directed slightly upwards is the *abdomen* (fig. 2).

The length of the body is 8 mm., and of the trunk alone 4 mm.

The *chelifers* are slender, with the hand longer than the scape, and slightly curved. The chelæ are long and narrow (fig. 10). The palm is about equal in length to the fingers. The immovable finger bears an even row of very powerful curved teeth. The movable finger is likewise armed with teeth, which are double the number of those of the immovable finger, and are straight and lanceolate. Setæ are few and scattered.

The *palps* have the normal five joints and are slender; except on the fourth and fifth joints, setæ are almost absent. The first joint is very short; the others are in the proportion of 14 : 15 : 11 : 11 (fig. 9).

The *ovigers* are ten-jointed, and arise, as aforesaid, from two processes in the ventral surface of the neck. The first three joints are short and stout, with no setæ; together they

are less than the length of the fourth joint. The proportion of this and the remaining joints is as

$$7.5 : 8.5 : 3.16 : 1.5 : .88 : .75.$$

The fifth joint is more slender than the fourth, and is markedly swollen at the distal extremity; and on the swelling are numerous hairs. The sixth joint is straight, with few setæ. The next four joints, in addition to scattered setæ, bear an even row of toothed spines numbering about 18, 12, 14, 13. The claw is powerful, with 15–17 small teeth on its inner edge (figs. 2, 7, and 8).

The *legs* are very long, attaining a length of 83 mm. Together the first and third coxæ are shorter than the second. The proportion of the remaining joints is as follows:—  
16 : 20 : 29 : 6.5 : 2.8.

The setæ increase in number distally, the last three joints being closely covered. In addition there is on the inner surface of each an even row of lanceolate larger setæ (fig. 5). The claw is powerful and one-third the length of the propodus. Accessory claws are well developed. The relative lengths of claw and accessory claws (in the same terms as above leg measurements) are as .92 : .25 (fig. 4).

In one specimen only were egg-masses seen: the eggs are very small (fig. 11).

In a large genus like *Nymphon*, where species are in the main characterized by differences in the relative size, or in the degree of development, of the several parts, or where one part may be enlarged and another diminished with little apparent order or connection, there is very little ground for assumption as to the actual kinship between one species and another. Among our Atlantic species, it is perhaps *N. longitarse* that this new species most resembles in general proportions both of limbs and body. On the other hand, the slender and graceful chelæ and chelifers more closely resemble those, for instance, of *N. macrum*, from which, however, this species is easily distinguished by other characters, such as those of the neck, the palp, the length of the tarsus, and the form of the ocular tubercle. In its assemblage of characters the present species could not, I think, be mistaken for any species yet described.

Co-types of the species have been presented by Miss Pixell to the British Museum (Natural History).

#### EXPLANATION OF PLATE VII.

- Fig.* 1. *Nymphon pixellæ*; dorsal view.  
*Fig.* 2. Profile view.  
*Fig.* 3. Ocular tubercle.  
*Fig.* 4. Terminal joints of leg.



- Fig. 5. Spines on terminal joints of leg.  
 Fig. 6. Dorsal view; walking-legs removed.  
 Fig. 7. Terminal joints of ovigerous leg.  
 Fig. 8. Spine of oviger.  
 Fig. 9. Palp.  
 Fig. 10. Chela.  
 Fig. 11. Oviger with egg-mass.

XXIV.—*A Revision of the South-American Siluroid Fishes of the Genus Corydoras, with a List of the Specimens in the British Museum (Natural History).* By C. TATE REGAN, M.A.

(Published by permission of the Trustees of the British Museum.)

THE Callichthyid fishes with the occipital process extending to the plate at the base of the dorsal fin-spine may be divided into two genera—*Corydoras*, Lacep., 1803, with 6 to 8 soft rays in the dorsal and the base of the fin about equal to its distance from the adipose fin, and *Brochis*, Cope, 1871, with 9 to 11 soft rays in the dorsal fin, which is more extended, its base considerably more than its distance from the adipose fin. In his recent list of Neotropical fishes Eigenmann recognizes the genus *Osteogaster*, Cope, including therein two species which have the humeral shields somewhat larger than usual. One of these is a *Corydoras*, viz. *C. eques*, Steind., which is closely related to *C. nattereri* and still more closely to *C. macrosteus*, described below as new; the other is of a very different type, and should, in my opinion, be placed in the genus *Brochis*; it is *B. splendens*, Casteln.

There are so many species of *Corydoras* unrepresented in the British Museum collection and of uncertain position that I find it difficult to make a satisfactory key to the species.

*Synopsis of the Species.*

- I. Interorbital width  $\frac{1}{3}$  the length of head or less; snout more than  $\frac{1}{2}$  the length of head.

Scutes in upper lateral series 23 .....	1. <i>treitlii</i> .
Scutes in upper lateral series 26 or 27 .....	2. <i>kroneri</i> .

- II. Interorbital width  $\frac{2}{5}$  the length of head or more.

A. A series of spots along the side and a second series on the back.

- |  |                          |
|--|--------------------------|
| 1. Diameter of eye 6 or 7 in length of head. . | 3. <i>micracanthus</i> . |
| 2. Diameter of eye 4 or 5 in length of head.   |                          |

Head $3\frac{2}{3}$ in the length .....	4. <i>microcephalus</i> .
Head $3\frac{1}{3}$ to $3\frac{1}{2}$ in the length .....	5. <i>paleatus</i> .

- |  |                    |
|--|--------------------|
| 3. Diameter of eye $3\frac{1}{4}$ in length of head .... | 6. <i>garbei</i> . |
|--|--------------------|

## B. Spots smaller and more numerous.

1. Operculum  $\frac{1}{2}$  as broad as deep ..... 7. *agassizii*.2. Operculum more than  $\frac{1}{2}$  as broad as deep.

a. Dorsal spine shorter than longest soft rays.

8-13. *multimaculatus*, *julii*, *elegans*, *trilineatus*,  
*punctatus*, *raimundi*.

b. Dorsal spine rarely a little shorter than first soft ray.

Dorsal spine longer than head ..... 14. *armatus*.Dorsal spine a little shorter than head ..... 15. *polystictus*.Dorsal spine as long as head ..... 16. *melanistius*.

## C. A black arrow-shaped spot at base of caudal fin.

17. *hastatus*.D. Dark undulating longitudinal stripes ..... 18. *undulatus*.

## E. A dark lateral band ; fins immaculate.

1. Depth of suborbital not more than its distance from upper lip.

a. Depth of body  $3\frac{1}{4}$  to  $3\frac{1}{3}$  in the length .. 19. *melanotænia*.b. Depth of body  $2\frac{1}{2}$  to 3 in the length.

Snout not shorter than postorbital part of head ;

edge of dorsal fin somewhat convex ..... 20. *æneus*.

Snout shorter than postorbital part of head ; edge

of dorsal fin straight ..... 21. *nattereri*.

2. Depth of suborbital twice its distance from the upper lip.

22. *macrosteus*.

3. Suborbital extending from eye to upper lip.

23. *eques*.1. *Corydoras treitlii*.

Steind. Anz. Akad. Wien, 1906, p. 478.

Depth of body equal to or a little more than length of head, which is  $2\frac{1}{2}$  to 3 in the length. Snout  $1\frac{1}{3}$  to  $1\frac{1}{2}$ , diameter of eye  $4\frac{1}{2}$  to 5, interorbital width 3 to  $3\frac{3}{4}$  in the length of head. Barbels reaching gill-opening. Dorsal I 8 ; adipose fin preceded by 4 or 5 median scutes. Anal I 7. Pectoral spine a little shorter than that of dorsal. Scutes 23/21. Brownish above, yellowish below ; a dark grey lateral stripe ; caudal usually with dark upper and lower margins, rarely with a few spots on the middle rays.

R. Parnahyba.

Total length 66 mm.

2. *Corydoras kronei*.

Ribeiro, A Lavoura, xi. no. 5, 1907, p. 189, fig. ; Steind. Anz. Akad. Wien, 1910, p. 61.

*Corydoras eigenmanni*, R. von Ihering, Rev. Mus. Paulist. i. 1907, p. 35.Depth of body about equal to length of head,  $3\frac{1}{2}$  to 4 in

the length. Snout more than  $\frac{1}{2}$  the length of head; diameter of eye 6 in length of head, interorbital width 3. Suborbital narrow; barbel nearly reaching gill-opening; males with bristles on sides of snout. Dorsal I 7-8; spine about  $\frac{3}{2}$  length of head; soft rays decreasing from first, the fourth or fifth as long as spine; base equal to or less than distance from adipose fin. Anal I 6-7. Pectoral spine extending a little beyond base of pelvics. Scutes 26-27/22-23; humeral shields wide apart, each separated by 2 scutes from base of pelvic fin. Dark blotches at bases of dorsal and adipose fins alternate and are connected with a series of blotches on the side, which may unite to form a band; head spotted or reticulated; dorsal and caudal with series of spots on rays; lower fins with or without spots.

1-4 (co-types of *C. eigenmanni*). 45-60 mm.

Near Santos.

R. von Ihering.

### 3. *Corydoras micracanthus*, sp. n.

Depth of body 3 to  $3\frac{1}{2}$  in the length, length of head 4. Diameter of eye 6 or 7 in length of head; snout as long as postorbital part of head or interorbital width. Suborbital narrow; barbels nearly or quite reaching gill-opening. Dorsal I 8; spine  $\frac{1}{2}$  the length of head; fin small, rounded, its base less than its distance from adipose fin, which is preceded by 1 or 2 median scutes. Anal I 6. Pectoral spine not reaching base of pelvic fin. Scutes 25/22; humeral shields widely separated below, each separated by 2 scutes from base of pelvic fin. Yellow, with a series of 3 to 6 dark brownish or purplish spots along the side and a second series on the back; dorsal dusky anteriorly, sometimes with spots on rays; caudal barred; lower fins immaculate.

1-8 (types). 35-50 mm.  
9-10.

Salta, Argentina.

" "

Borelli.  
Steinbach.

### 4. *Corydoras microcephalus*, sp. n.

Depth of body 3 in the length, length of head  $3\frac{3}{4}$ . Snout as long as or a little longer than postorbital part of head; diameter of eye  $4\frac{1}{2}$  in the length of head, interorbital width  $2\frac{1}{2}$ . Suborbital narrow; barbel nearly reaching gill-opening. Dorsal I 6-7; spine  $\frac{3}{2}$  to  $\frac{2}{3}$  the length of head; first and second rays longest, the edge of fin slightly convex; base about equal to distance from adipose fin, which is preceded by 1 or 2 median scutes. Anal I 6. Pectoral spine extending to base of pelvics. Scutes 22-23/20; humeral shields

not in contact below, each separated by  $1\frac{1}{2}$  scutes from base of pelvic fin. A lateral series of 4 or 5 dark oblong spots, the third below the adipose fin; a similar series of spots on the back; dorsal dusky anteriorly and usually with spots on the rays; caudal usually barred with series of spots; lower fins immaculate or anal sometimes with a spot.

1-4 (types). 50 mm.

La Plata.

Doria.

### 5. *Corydoras paleatus*.

*Callichthys paleatus*, Jenyns, Zool. 'Beagle,' Fish. p. 113 (1842).

*Corydoras marmoratus*, Steind. Denkschr. Akad. Wien, 1879, p. 26, pl. v. fig. 1.

*Corydoras paleatus*, Eigenm. & Eigenm. Occ. Pap. Calif. Acad. i. 1890, p. 471.

? *Corydoras aurofrenatus*, Eigenm. & Kennedy, Proc. Acad. Philad. 1903, p. 507; Eigenm. & Ward, Ann. Carnegie Mus. iv. 1907, pl. xxxviii. fig. 4.

*Corydoras ehrhardti*, Steind. Anz. Akad. Wien, 1910, p. 60.

? *Corydoras meridionalis*, R. von Ihering, Rev. Mus. Paulist. viii. 1911, p. 381.

? *Corydoras nattereri triseriatus*, von Ihering, t. c. p. 386.

? *Corydoras flaveolus*, von Ihering, t. c. p. 387.

Depth of body  $2\frac{3}{5}$  to 3 in the length, length of head  $3\frac{1}{3}$  to  $3\frac{1}{2}$ . Snout as long as or a little longer than postorbital part of head; diameter of eye 4 to 5 in the length of head, interorbital width 2 to  $2\frac{1}{2}$ . Suborbital narrow; barbel rarely reaching gill-opening. Dorsal I 7-8; spine  $\frac{2}{3}$  to as long as head; soft rays decreasing from first, which is longer than spine; base nearly equal to distance from adipose fin, which is preceded by 2 or 3 median scutes. Anal I 6. Pectoral spine extending to or beyond base of pelvics. Scutes 22-24/20-22; humeral shields not in contact below, each separated from base of pelvic fin by one scute. Three oblong dark spots along middle of side, respectively below the dorsal and adipose fins and on the caudal peduncle, connected with less definite spots on the back; both series of spots may unite to form longitudinal bands; dorsal dusky anteriorly and with spots on the rays; caudal barred; lower fins each with a single spot; sometimes some or all the fins immaculate.

La Plata; Rio Grande do Sul; Sta. Catharina.

1 (one of the types). 35 mm.

2-3. 70 mm.

4-6. 60 mm.

7-9. 25 mm.

10-11. Dried.

12 (co-type of *C. ehrhardti*).

Buenos Ayres.

Parana.

R. Grande do Sul.

Cordova.

Joinville.

Cambridge Mus.

White.

Salmin.

von Ihering.

Steindachner.



6. *Corydoras garbei*.

R. von Ihering, Rev. Mus. Paulist. viii, 1910, p. 383 (1911).

Depth of body  $2\frac{2}{3}$  in the length, length of head 3. Snout 2 in length of head, interorbital width a little more than 2, diameter of eye  $3\frac{1}{4}$ . Barbels reaching gill-opening. Dorsal spine shorter than that of pectoral; base of dorsal longer than distance from adipose fin, which is preceded by 1 or 2 median scutes. A series of 5 spots along the side and 4 along the back; dorsal blackish anteriorly; caudal with 4 cross-bars.

Length 50 mm,

Rio San Francisco.

7. *Corydoras agassizii*.

? *Corydoras ambiacus*, Cope, Proc. Acad. Philad. 1871, p. 280.

*Corydoras agassizii*, Steind. Sitzungsab. Akad. Wien, lxxiv. 1877, p. 138, pl. xii. fig. 2.

? *Corydoras punctatus*, Eigenm. & Eigenm. Occ. Pap. Calif. Acad. i, 1890, p. 472.

Depth of body  $2\frac{1}{2}$  to  $2\frac{3}{5}$  in the length, length of head  $3\frac{1}{4}$ . Snout nearly  $\frac{1}{2}$  length of head; diameter of eye 4 in length of head, interorbital width 2. Suborbital narrow, separated by a broad naked space from upper lip; barbels reaching gill-opening; operculum twice as deep as broad. Dorsal 17; spine  $\frac{3}{4}$  length of head; soft rays decreasing from first, which is longer than spine; edge of fin slightly concave; base equal to distance from adipose fin, which is preceded by 3 median scutes. Anal 6-7. Pectoral spine extending beyond base of pelvics. Scutes 23/21; humeral shields not in contact below, each separated by one scute from base of pelvic fin. Sides with small brown spots; a yellowish lateral band bearing 3 longitudinal series of spots; dorsal blackish anteriorly and with series of spots on the rays; caudal barred with series of spots; anal spotted; pelvics and anal immaculate.

Amazon.

Total length 60 mm.

1. 25 mm,

R. Jurua.

Bach,

This specimen is too small for description, but shows the characteristic deep snout and narrow operculum.

8. *Corydoras multimaculatus*.

Steind. Anz. Akad. Wien, 1907, p. 291.

Depth of body  $2\frac{2}{3}$  to more than  $2\frac{1}{2}$  in the length, length of  
Ann. & Mag. N. Hist, Ser. 8. Vol. x. 15

head 3. Snout  $1\frac{2}{3}$  to nearly 2 in the length of head, diameter of eye 5, interorbital width 2. Barbels reaching gill-opening. Dorsal I 8; height of fin  $1\frac{2}{3}$  to  $1\frac{1}{2}$  in depth of body; base equal to distance from adipose fin, which is preceded by 2 median scutes. Anal I 6. Scutes 22/20. Head, body, and fins with numerous small dark spots.

Rio Preto, Bahia.

Total length 44 mm.

### 9. *Corydoras julii*.

Steind. Anz. Akad. Wien, 1906, p. 480.

Depth of body  $2\frac{1}{2}$  to  $2\frac{2}{3}$  in the length, length of head 3 to  $3\frac{1}{3}$ . Snout 2 in length of head, diameter of eye 4, interorbital width 2. Barbels not reaching gill-opening. Dorsal I 8; spine a little shorter than that of pectoral, which is as long as head; 3 median scutes before adipose fin. Anal I 6. Scutes 21/20. Head, upper  $\frac{2}{3}$  of body, dorsal and caudal fins with numerous small dark spots, those on the caudal forming 7 to 10 transverse series. A lateral series of larger spots and a large black spot on upper part of dorsal fin.

R. Parahim.

Total length 52 mm.

### 10. *Corydoras elegans*.

Steind. Sitzungsb. Akad. Wien, lxxiv. 1876, p. 471; Eigenm. & Eigenm. Occ. Pap. Calif. Acad. i. 1890, p. 469.

Depth of body  $2\frac{2}{3}$  in the length, length of head  $3\frac{1}{2}$  to 4. Snout as long as or a little longer than postorbital part of head; diameter of eye  $3\frac{1}{3}$  to  $3\frac{1}{2}$  in the length of head, interorbital width 2. Suborbital narrow; barbel extending to gill-opening; breadth of operculum more than  $\frac{1}{2}$  its depth. Dorsal I 7; spine as long as or a little shorter than head; rays decreasing from first or second, which are longer than spine; free edge straight or slightly convex; base about equal to distance from adipose fin, which is preceded by 2 or 3 median scutes. Anal I 6. Pectoral spine as long as head, extending beyond base of pelvics. Scutes 22-23/20; humeral shields not in contact, each separated by 1 or  $1\frac{1}{2}$  scutes from base of pelvic fin. Yellowish; 3 series of brownish spots along middle of side; above them a brown band tapering posteriorly and a narrow band on each side of back; dorsal blackish superiorly; other fins immaculate.

Amazon (Cudajas and T'effé).

1-6. 40-50 mm.

Cudajas.

Mus. Comp. Zool.

11. *Corydoras trilineatus*.

Cope, Proc. Acad. Philad. 1871, p. 281, pl. vi. fig. 2.

? *Corydoras acutus*, Cope, *l. c.*

Very closely related to *C. elegans*, but with a larger eye, its diameter  $\frac{1}{3}$  the length of head in a specimen of 49 mm. A yellowish lateral band with brownish margin above and below and blackish median line; dorsal rays blackish superiorly; caudal barred; anal spotted.

Ambyiacu R.

According to Eigenmann this species is the same as *C. agassizii*, but it has the shorter snout and broader operculum of *C. elegans*.

12. *Corydoras punctatus*.

*Cataphractus punctatus*, Bloch, Ausl. Fisch. pl. cccxxvii. fig. 2 (1794).

A species resembling *C. elegans* and *C. trilineatus* in form and in coloration, the dorsal fin blackish superiorly and some spots along the middle of the side; caudal barred.

Surinam.

13. *Corydoras raimundi*.

Steind. Anz. Akad. Wien, 1907, p. 84.

Depth of body 3 to 4 in the length, length of head  $3\frac{1}{4}$  to  $3\frac{1}{2}$ . Diameter of eye 5 to 6 in the length of head, interorbital width 2, length of snout 2. Dorsal I 8. Anal I 6. Pectoral fin usually a little shorter than head. Scutes 23-25/22-23. 3 longitudinal series of greyish-violet spots on the body; a blackish band across middle of dorsal fin; caudal with cross-bars.

Rio Parnahyba near Victoria,

14. *Corydoras armatus*.

*Callichthys armatus*, Günth. Proc. Zool. Soc. 1863, p. 230, fig.

? *Corydoras amphibelus*, Cope, Proc. Acad. Philad. 1871, p. 282.

Depth of body  $2\frac{1}{3}$  to  $2\frac{1}{2}$  in the length, length of head  $3\frac{1}{2}$ . Snout a little longer than eye, the diameter of which is  $3\frac{1}{3}$  in the length of head; interorbital width 2. Suborbital narrow, its depth less than  $\frac{1}{2}$  diameter of eye; barbel not reaching gill-opening. Dorsal I 7-8; spine as long as depth of body below it; soft rays decreasing from first, which is a little shorter than spine; base equal to or a little more than distance from adipose fin, which is preceded by 4 or 5 median scutes. Anal I 6-7. Pectoral spine as long as or

longer than head, extending to or beyond middle of pelvics. Scutes 22–23/20; humeral shields not in contact below, each separated by one scute from base of pelvic fin. Sides with small dark spots, strongest anteriorly, and forming longitudinal series above and below the lateral line; traces of spots on dorsal rays; other fins immaculate.

R. Amazon.

1–2 (types). 60 mm.

3–4. 55 mm.

5–8. 30–35 mm.

Xeberos.

Huallagas.

R. Jurua.

Higgins.

"

Bach.

According to Cope's description *C. amphibelus* seems to differ from *C. armatus* only in the barred caudal fin.

### 15. *Corydoras polystictus*, sp. n.

Depth of body  $2\frac{1}{3}$  to  $2\frac{1}{2}$  in the length, length of head  $3\frac{1}{4}$  to  $3\frac{1}{2}$ . Snout strongly decurved, a little longer than diameter of eye, which is 3 in the length of head; interorbital width 2. Suborbital narrow; barbel nearly reaching gill-opening. Dorsal I 7; spine nearly as long as head; soft rays decreasing from first, which is as long as or a little longer than spine; base more than distance from adipose fin, which is preceded by 2 median scutes. Anal I 6. Pectoral spine as long as head, extending to middle of pelvics. Scutes 21–22/19–20. Longitudinal series of small dark spots on sides of body and on rays of dorsal fin; other fins immaculate.

1–2 (types). 35 mm.

Descalvados, Matto Grosso.

Ternetz.

### 16. *Corydoras melanistius*, sp. n.

*Callichthys punctatus* (non Bloch), Günth. Cat. Fish. v. p. 229 (1861).

Depth of body  $2\frac{1}{2}$  in the length, length of head  $3\frac{1}{2}$ . Snout nearly  $\frac{1}{2}$  length of head; diameter of eye  $3\frac{1}{2}$  in the length of head, interorbital width 2 to  $2\frac{1}{3}$ . Suborbital narrow, its depth about  $\frac{1}{2}$  diameter of eye; barbel not reaching gill-opening. Dorsal I 7; spine as long as head; soft rays decreasing from first, which is as long as spine; base a little more than distance from adipose fin, which is preceded by 4 median scutes. Anal I 6. Pectoral spine as long as or longer than head, extending to or beyond middle of pelvics. Scutes 21–23/19–20; humeral shields not in contact below, each separated by one scute from base of pelvic fin. 3 or 4 series of small dark spots on side; dorsal fin blackish, the colour extending on to the back below it; other fins pale, immaculate.

1–2 (types). 50 mm.

Essequibo.

Ehrhardt.



17. *Corydoras hastatus*.

Eigenm. & Eigenm. Proc. Calif. Acad. (2) i. 1888, p. 166, and Occ. Pap. Calif. Acad. i. 1890, p. 474.

Depth of body  $2\frac{3}{4}$  in the length, length of head  $3\frac{1}{3}$ . Diameter of eye  $3\frac{1}{2}$  in length of head and 2 in interorbital width. Barbels not extending beyond eye. Dorsal I 7-8; spine nearly as long as head. Anal 7-8. Pectoral spine a little longer than dorsal spine. Scutes 22/20; humeral shields not in contact below. Light brown; a jet-black lateral band ending at base of caudal in a large arrow-shaped spot; bordered posteriorly with white and again with a narrow blackish margin; minute black points on body and fins.

Amazon at Villa Bella.

*Corydoras australis*, Eigenm. & Ward (Ann. Carnegie Mus. iv. 1907, p. 123), from Paraguay, is said to be very closely related to *hastatus*, and perhaps identical with it; it has the same caudal spot, but the lateral band is represented by an indistinct dusky line.

18. *Corydoras undulatus*, sp. n.

*Corydoras microps* (non Eigenm. & Kennedy), Eigenm. & Ward, Ann. Carnegie Mus. iv. 1907, p. 123, pl. xxxviii. figs. 2, 3.

Depth of body  $2\frac{1}{3}$  to  $2\frac{1}{2}$  in the length, length of head  $3\frac{1}{2}$  to 4. Diameter of eye 5 to 6 in length of head, interorbital width  $1\frac{1}{2}$  to  $1\frac{3}{4}$ . Snout nearly as long as postorbital part of head; præorbital narrow; barbel nearly or quite reaching gill-opening. Occipital plate a little longer than broad. Dorsal I 7-8; spine  $\frac{2}{3}$  length of head; second and third soft rays longest, fifth as long as spine; base of fin longer than distance from adipose, which is preceded by 3 or 4 median scutes. Anal I 7. Caudal deeply emarginate. Pectoral spine extending to base of pelvics. Scutes  $\frac{21-23}{19-20}$ ; humeral shields not in contact below, on each side separated by a single scute from base of pelvics. Yellowish, with dark purplish spots tending to run together, forming undulating longitudinal bands; fins with or without series of spots.

La Plata.

1 (type). 55 mm.  
2-3. 35 mm.

La Plata.  
,,

Wolterstorff.  
Arnold.

19. *Corydoras melanotænia*, sp. n.

Depth of body  $3\frac{1}{4}$  to  $3\frac{1}{3}$  in the length, length of head  $3\frac{1}{2}$  to  $3\frac{3}{4}$ . Diameter of eye  $5\frac{1}{2}$  in the length of head, interorbital

width  $2\frac{1}{4}$  to  $2\frac{1}{3}$ . Snout  $\frac{1}{2}$  the length of head; suborbital a little narrower than diameter of eye; barbel nearly or quite reaching gill-opening. Dorsal I 7; spine about  $\frac{3}{5}$  length of head; 3 or 4 rays longer than spine; edge of fin slightly convex; base nearly equal to distance from adipose fin, which is preceded by 3 or 4 median scutes. Anal I 6. Pectoral spine extending to base of pelvic. Scutes  $\frac{21}{22}$ ; humeral shields widely separated below, and each separated by one scute from base of pelvic fin. Brownish above, yellowish below; a broad blackish lateral band; fins immaculate.

Colombia.

1-2 (types). 50 mm.

Honda.

Leighton.

From *C. æneus* of the same size they differ in the more elongate form, smaller head, longer snout, narrower interorbital region, and more numerous scutes.

## 20. *Corydoras æneus*.

*Hoplosoma æneum*, Gill, Ann. Lyc. N. York, vi. 1858, p. 403.

*Corydoras microps*, Eigenm. & Kennedy, Proc. Acad. Philad. 1903, p. 506.

? *Corydoras venezuelanus*, R. von Ihering, Rev. Mus. Paulist. viii. 1911, p. 385.

Depth of body  $2\frac{1}{2}$  to 3 in the length, length of head  $3\frac{1}{3}$  to  $3\frac{2}{3}$ . Diameter of eye 5 to 6 in length of head, interorbital width 2. Snout as long as or longer than postorbital part of head; suborbital not very narrow, in the adult its depth about equals the diameter of eye or its distance from upper lip; barbels usually extending to gill-opening. Dorsal I 7-8; spine  $\frac{2}{5}$  to  $\frac{3}{5}$  the length of head; first or second soft rays longest, 2 to 6 rays longer than spine, free edge slightly convex; base about equal to distance from adipose fin, which is preceded by 3 to 5 median scutes. Anal I 6-7. Caudal deeply emarginate. Pectoral spine extending to or beyond base of pelvics. Scutes  $\frac{21-23}{19-21}$ ; humeral shields not in contact below, on each side separated by a single scute from base of pelvic fins. Brownish above, yellowish below; a blackish lateral band broadening anteriorly into a blotch, which may join others on occiput and at base of dorsal fin; fins immaculate.

Trinidad to La Plata.

1-3. 70 mm.	Granada.	Higgins.
4-5. 50-60 mm.	Trinidad.	Guppy.
6-8. 40 mm.	"	Hart.
9. 60 mm.	Urucum, Matto Grosso.	Borelli.
10-11. 40-50 mm.	Carandasinho, Matto Grosso.	"
12. 70 mm.	Sara, Bolivia.	Steinbach.

21. *Corydoras nattereri*.

Steind. Sitzungsab. Akad. Wien, lxxiv. 1877, p. 143, pl. xi. fig. 1.

*Corydoras juquiae*, R. von Ihering, Rev. Mus. Paulist. i. 1907, p. 37.

Depth of body  $2\frac{2}{3}$  to 3 in the length, length of head  $3\frac{1}{3}$  to  $3\frac{1}{2}$ . Diameter of eye  $3\frac{1}{2}$  to 4 in the length of head, interorbital width  $2\frac{1}{3}$  to  $2\frac{1}{2}$ . Snout blunt, shorter than postorbital part of head; suborbital narrow, less than diameter of eye; barbels just reaching gill-opening. Occipital plate longer than broad. Dorsal I 7; spine  $\frac{3}{5}$  to  $\frac{4}{5}$  the length of head; free edge of fin straight, the rays decreasing from the first; 1, 2, or 3 longer than spine; base about equal to distance from adipose fin, which is preceded by 2 to 4 median scutes. Anal I 5-7. Caudal deeply emarginate. Pectoral spine reaching anterior part or middle of pelvics. Scutes  $\frac{21-23}{20-21}$ ; humeral shields not in contact below, on each side separated by one scute from base of pelvics. A dark lateral band broadening forwards; a dark spot below anterior part of dorsal fin; fins immaculate.

Eastern Brazil.

1-2. 50-55 mm.

Rio Janeiro.

R. von Ihering.

3-4 (co-types of *C. juquiae*).

R. Juquia, S. Paulo.

„

50-55 mm.

22. *Corydoras macrosteus*, sp. n.

Depth of body  $2\frac{3}{5}$  to 3 in the length, length of head  $3\frac{3}{5}$  to  $3\frac{4}{5}$ . Diameter of eye 6 in length of head, interorbital width 2. Snout  $\frac{1}{2}$  the length of head or less; suborbital deep,  $1\frac{1}{2}$  the diameter of eye and twice its distance from the upper lip; barbels reaching gill-opening. Occipital plate longer than broad; process with concave edges. Dorsal I 7; spine  $\frac{1}{2}$  the length of head or less; fin rounded, with 5 or 6 rays longer than spine; base less than distance from adipose fin, which is preceded by 3 or 4 median scutes. Anal I 6. Caudal emarginate. Pectoral spine reaching base of pelvics. Scutes  $\frac{23-24}{21-22}$ ; humeral shields not in contact, on each side separated by one scute from base of pelvic fins. Brownish above, yellowish below; a broad dark lateral band tapering backwards; fins dusky.

San Paulo, Brazil.

1-4 (types). 60 mm.

Rio Piracicaba, San Paulo.

R. von Ihering.

23. *Corydoras eques*.

Steind. Sitzungsab. Akad. Wien, lxxiv. 1877, p. 140, pl. xii. fig. 3.

Depth of body  $2\frac{1}{2}$  in the length, length of head  $3\frac{1}{3}$ . Diameter of eye 4 in length of head, interorbital width  $2\frac{1}{4}$ . Snout as long as postorbital part of head; suborbital very deep, reaching upper lip; barbel reaching gill-opening. Dorsal I 7; spine nearly as long as head; free edge of fin convex, with 2 rays longer than spine; 3 median scutes before adipose fin. Anal I 7. Caudal emarginate. Pectoral spine reaching middle of pelvics. Scutes  $\frac{22-23}{20-21}$ ; humeral shields large, reaching base of pelvics and meeting below. Brownish above, yellowish below, with a broad blackish lateral band tapering backwards; fins immaculate.

Amazons (Teffé and Cudajas).

XXV.—*Some Considerations in regard to the Classification of the Order Thysanoptera*. By RICHARD S. BAGNALL, F.L.S., F.E.S., Hope Department of Zoology, University Museum, Oxford.

SINCE my papers on the Urothripidae were published\*, I have come to the conclusion that in retaining that family as a family of the suborder Tubulifera unnecessary difficulties will be created. I have already shown that whereas *Urothrips* superficially resembles the Tubulifera very closely, it really differs from true Tubulifera more strongly in its structure than do the members of the suborder Terebrantia; or, in other words, the two suborders Tubulifera and Terebrantia are more closely related to each other than *Urothrips* to either. I am now convinced that the only course one can reasonably take is to erect a new suborder for the reception of the family Urothripidae, for which I propose the name

## POLYSTIGMATA,

suggested by the character that appears to me to be of the greatest taxonomic value.

It will be well to briefly diagnose the three suborders.

\* Annales Musei Nationalis Hungarici, 1909, vii. pp. 125-136, pl. iii., & Mém. 1<sup>er</sup> Congrès International d'Entomologie, 1910, pp. 283-288.



## Order THYSANOPTERA.

- I. *Eleven pairs of stigmata present; hind pair of coxæ most widely separated; palpi single-jointed.* (Species bearing a close general resemblance to the Tubulifera; ocelli and wings absent; antennæ 7-jointed, joints broad and strongly characteristic; spiracular openings large and protected externally by specialized dorso-lateral papillæ; ninth abdominal segment elongated, longer than the preceding; intermediate terminal hairs obsolete.)

Suborder POLYSTIGMATA, mihi.

Containing the family *Urothripidæ*, Bagnall.

- II. *Not more than four pairs of stigmata present: intermediate pair of coxæ most widely separated; palpi never less than 2-jointed.*

1. Female without an ovipositor; last abdominal segment tubular in both sexes (ninth abdominal segment not exceptionally elongated, and intermediate terminal hairs present; antennæ composed of eight more or less strongly elongated and slender joints\*, certain of which bear one or more sense-cones). Lower and upper wings, when present, similar in structure, with only one median longitudinal vein, which is only partially developed, sometimes obsolete, and never reaches the tip of wing.

Suborder TUBULIFERA, Haliday.

Containing the diagnosed families *Phlæothripidæ*, Haliday, and *Idolothripidæ*, Bagnall.

2. Female with a saw-like ovipositor; last abdominal segment usually conical, that of male unlike the females and usually bluntly rounded. Fore wing with at least one longitudinal vein reaching from base to tip of wing. (The structure of the wings, palpi, antennæ, and ovipositor affords good characters for tabulating the families.)

Suborder TEREBRANTIA, Haliday.

Containing the diagnosed families *Æolothripidæ*, Haliday, and *Thripidæ*, Haliday.

When Uzel monographed the Thysanoptera in 1895 the ultra-European species were unworked. Since then the North-American forms have received a good deal of attention, whilst material from tropical and subtropical regions is being received and dealt with. As a natural consequence, highly specialized forms and groups of species that cannot be regarded as members of the previously diagnosed families have been discovered, though the tendency with workers in the order has been to regard the three families *Phlæothripidæ*, *Æolothripidæ*, and *Thripidæ* as fixed and to fit new and specialized genera into one or the other. To eliminate difficulties as far as possible, I think it very desirable to make certain divisions and subdivisions to receive certain genera and groups, but shall be able to write more on this matter when I have had the opportunity of

\* A few species possess 7-jointed antennæ, undoubtedly derived by the fusion of the seventh and eighth joints.

working out certain anomalous material now in my possession.

In the meantime I would recommend that the following specialized genera be regarded as the types of distinct divisions, which we may, for the moment, regard as families:—

#### TEREBRANTIA.

*Heterothrips*, Hood (nec Buffa) (THRIPIDÆ), on account of the structure and segmentation of the antennæ, the character of the sensoria, and the tarsal appendages. HETEROTHRIPIDÆ, mihi.

*Panchætothrips*, Bagnall (THRIPIDÆ), on account of the structure of the head, the abdomen, last abdominal segment and ovipositor in female, and venation of fore wings. PANCHÆTOTHRIPIDÆ, mihi.

*Ceratothrips*, Reuter, chiefly on account of the 6-jointed antennæ, which possess only a single-jointed style, the reduction in the antennal joints not being caused by fusion. CERATOTHRIPIDÆ, mihi.

#### TUBULIFERA.

*Ecacanthothrips*, Bagnall (PHLÆOTHRIPIDÆ), chiefly on account of the specialized antennal sense-cones congregated (in the form of numerous fingers) on the third antennal joint. ECACANTHOTHRIPIDÆ, mihi.

XXVI.—*Entomological Notes from the London School of Tropical Medicine*.—No. IV. *Blood-sucking Diptera from Port Darwin, Australia*. By SOPHIA L. M. SUMMERS, M.A., B.Sc., Carnegie Student of Aberdeen University.

Dr. C. L. STRANGMAN has recently presented to the School a collection of blood-sucking flies collected by himself in Port Darwin and its neighbourhood, in the northern territory of the Government of South Australia. It includes eighteen species, and as very little seems to be known of the blood-sucking Diptera of this part of the world, it seems advisable in describing several of the new forms to put the names of all the species on record. All the identifications have been confirmed from the collections in the British Museum (Natural History) and may therefore be regarded as authentic.

I take this opportunity of renewing my acknowledgments to Messrs. E. E. Austen and F. W. Edwards for their kindness in giving me access to the collections in their charge.

## Family Culicidæ.

## Subfamily CULICINÆ.

## Section CULICINI.

1. *Taniorhynchus brevicellulus*, Theob.

This species exhibits a considerable range of variety in colour.

2. *Mansonioides uniformis* (Theob.).3. *Stegomyia fasciata*, Fabr.4. *Ochlerotatus vigilax* (Skuse).

These four species appear to be common.

5. *Mucidus alternans*, Westwood.

## Section ANOPHELINI.

6. *Anopheles* (*Myzorhynchus*) *bancroftii*, Giles.

Appears to be common.

I leave the name, as these specimens are not in the best condition, but for my own part I am convinced there is no difference between this species and *A. barbirostris*, V. de Wulp. The spots in the fringe are not merely variable in this and other species of the subgenus, but also they depend to some extent on the angle from which the light is reflected.

7. *Anopheles* (*Nyssorhynchus*) *annulipes*, Walker.

This specimen has been compared with those in the British Museum (Nat. Hist.) and differs only in having scales on all the abdominal terga. Scales are extremely scanty on the first tergum, slightly more numerous on the second, still more numerous on the third, and fairly abundant on all the rest. If the artificial classification of Theobald were adopted this specimen would be included in the "genus" *Neocellia*. There seems good reason to suppose that in the subgenus *Nyssorhynchus*, using the term in a wide sense, to include all the forms catalogued by Theobald under *Nyssorhynchus*, *Neocellia*, and *Cellia*, the amount of the scaling on the abdomen is often a fluctuating and inconstant character.

Family **Tabanidæ**.Subfamily *TABANINÆ*.8. *Tabanus brevivitta*, Walker.9. *Tabanus serus*, Walker.10. *Tabanus cinerascens*, King.

These three species seem to be common.

11. *Tabanus* sp. prox. *serus*, Walker.

Three females which have been stewed in their own juice, and are consequently too much discoloured for description, resemble *T. serus* very closely, but differ: (1) the antennæ are entirely black, while in *T. serus* only the tips are black; (2) the front is much narrower and the frontal callus is of quite a different shape.

12. *Tabanus elestëem*, sp. n.13. *Tabanus badius*, sp. n.14. *Tabanus anellosus*, sp. n.Subfamily *PANGONINÆ*.15. *Silvius strangmani*, sp. n.16. *Silvius mansonii*, sp. n.17. *Silvius alcocki*, sp. n.Family **Muscidæ**.Subfamily *STOMOXEINÆ*.18. *Lyperosia exigua*, Meijere.

This seems to be the first record of any species of *Lyperosia* from Australia. According to Dr. Strangman, it is known locally as the buffalo-fly.

## DIAGNOSES OF THE NEW SPECIES.

*Tabanus elestëem*, sp. n.

Smallish species, length 12 mm.

Two females.

*Face* and *palps* hoary, covered with long white hairs; *palps* a little more than half the length of the *proboscis*, which is black and rather slender for a *Tabanus*.



*Antennæ* dark rusty brown, the first two segments covered with short black bristles; basal angle of the third well pronounced.

*Front* wide, maximum breadth one-sixth that of the head, sides slightly convergent anteriorly, grey with some sparse hairs. *Frontal callus* in two parts, namely a large tumid shiny plug filling the whole front just above the antennæ, and a short somewhat ill-defined streak above. *Eyes* quite bare.

The denuded *scutum* is dark rusty brown inclining to black; *scutellum* reddish brown.

*Legs*: first pair black, except the proximal two-thirds of the tibiæ, which are reddish brown; the other two pairs are reddish yellow, except the tarsi and tip of the tibiæ, which are dark brown.

*Wings* hyaline, with a long dark brown spot at the distal end of the first longitudinal vein; the root of the veins is light brown, the rest dark brown. The upper branch of the third longitudinal vein is angulated, a short blind branch running inwards from the angle. *Halteres* reddish brown.

The *abdomen* (which is badly rubbed) appears dorsally to be seven-striped—three light stripes alternating with four black; the middle stripe, which is whitish, is strikingly distinct, the two dorso-lateral light stripes are not so distinct.

*Tabanus badius*, sp. n.

Also a smallish species, length 11 mm.

Four females.

*Face* grey, with long white hairs; *palps* about nine-tenths the length of the proboscis, light brown frosted with white; *proboscis* black, rather slender for a *Tabanus*.

*Antennæ* brown, black at the tip; first two segments with stout black hairs.

*Front* uniformly narrow (sides parallel), about one-ninth the breadth of the head, dirty yellow with numerous short black hairs. *Frontal callus* shiny black, racquet-shaped with the handle slender and not always well defined. *Eyes* quite bare.

*Scutum* and *scutellum* black, with a greyish dust and scattered golden and black hairs.

*Legs*: first pair black, except the proximal half to two-thirds of tibiæ which are reddish brown; second and third pairs reddish brown, tarsi black.

*Wings* hyaline, with a long very light brown spot at the distal end of the first longitudinal vein; veins dark brown. *Halteres* reddish brown.

*Abdomen* reddish brown; distal segments darker, with scattered hairs, of which many are black and a few golden.

This species can be readily distinguished from *T. elestēm* by the parallel-sided and much narrower front, by the shape of the frontal callus, by the very much longer palps, and by the nearly uniformly coloured abdomen.

*Tabanus anellozus*, sp. n.

Small species, length 9 mm.

Five females.

*Face* grey, with long white hairs. *Palps* reddish yellow, slender, about two-thirds the length of the *proboscis*, which is black and remarkably slender.

*Antennae* reddish brown, the rings of the third segment black, and the basal tooth acuminate.

*Front* uniformly narrow, one-ninth the breadth of the head, dirty yellow; *frontal callus* elongate triangular, shiny black. *Eyes* quite bare.

*Scutum* and *scutellum* black, with grey dust and scattered hairs, black and a few golden.

*Legs*: femora and tarsi of all the legs black; tibiae of the first pair black with red base, tibiae of the second and third pairs reddish brown with black tip.

*Wings* hyaline, with a long brown mark at the distal end of the first longitudinal vein. *Halteres* dark brown.

*Abdomen*: the first three segments of a reddish-brown colour, the second having a small black median triangle; the remaining segments black. At the hinder edge of each segment is a row of golden hairs, which on the black segments form distinct fine cross-bands.

*Silvius mansonii*, sp. n.

Length 11.6–13 mm.

Four females.

*Face* grey, with long white or yellowish-white hairs; *palps* a little more than three-quarters the length of the *proboscis*, extremely slender, reddish brown with black abruptly truncate tip; *proboscis* black, long and slender.

*Antennae* reddish brown, third segment broadly triangular at base and then becoming very slender.

*Front* wide, about one-sixth the width of head, slightly convergent anteriorly, dirty yellow. *Frontal callus* shiny black, divided into two parts—the upper elongate triangular, almost racquet-shaped, prolonged to the ocelli which are very distinct; the lower a large shiny black plug. *Eyes* quite bare.

*Scutum* and *scutellum* black dusted with grey, with curved golden hairs.

*Legs* reddish brown, tarsi dark brown. Spines on the hind tibiae small but conspicuous in a specimen cleared and mounted in Canada balsam. Spurs on the middle tibiae long and stout.

*Wings* hyaline, with a long pale yellow spot at the distal end of the first longitudinal vein, subcostal vein very pale yellow; other veins dark brown. *Halteres* reddish brown.

*Abdomen* reddish brown, with black and golden hairs; the last two or three segments dark brown or black.

I have much pleasure in naming this species after Sir Patrick Manson, G.C.M.G., F.R.S., &c.

*Silvius alcocki*, sp. n.

Small species, length 9 mm.

Two females.

*Face* grey, with long grey hairs; *palps* light brown, slender, about two-thirds the length of the *proboscis*, which is black, long, and slender.

*Antennae* black; third segment with a distinct *Tabanus*-like basal angle.

*Front* uniformly wide, about one-sixth the breadth of the head, grey. *Frontal callus* a rather narrow stripe, neither prominent nor shiny, squarely dilated above the root of the antennae and somewhat triangularly dilated higher up. *Ocelli* distinct but not prominent. *Eyes* quite bare.

*Scutum* (denuded) with three dark brown stripes, of which the median one is the broadest; *scutellum* black.

*Legs* black, the tibiae and tarsi of the second pair perhaps not quite so dark as other parts; spurs on the hind tibiae strong and conspicuous, reddish brown.

*Wings* hyaline, with a very dark brown, almost black, spot at the distal end of the first longitudinal vein. *Halteres* very dark brown.

*Abdomen* reddish brown to warm sepia, the anterior segments lighter than the others. The extreme hind margin of every segment is lighter and is clad with whitish hairs, so that the whole abdomen appears narrowly cross-banded.

*Silvius strangmani*, sp. n.

Small species, length 9 mm.

Two females.

*Face* dark grey, with dark grey hairs. *Palps* very slender, about two-thirds the length of the *proboscis*, truncate tips, reddish brown. *Proboscis* black, long and slender.

*Antennæ* reddish brown; third segment broadly triangular at the base.

*Front* uniformly wide, about one-sixth the breadth of the head. *Frontal callus* black, tumid and very shiny, consisting of two separate parts—namely, a large trapezium completely filling the space above the base of the antennæ, and a smaller somewhat oval patch higher up. *Ocelli* large and very prominent. *Eyes* quite bare.

*Scutum* and *scutellum* (denuded) dark.

*Legs* reddish brown, tibiæ and tarsi of first pair black. Spurs on hind tibiæ small, reddish brown.

*Wings* hyaline, with a long light-brown spot at the distal end of the first longitudinal vein. *Halteres* dark brown.

*Abdomen* very distinctly cross-banded—the after edge of every segment being light brown; the rest of the segment being purplish brown in the case of the first two segments, blackish brown in the case of the other segments.

This species is very similar to *S. alcocki* in size and general appearance. It can be distinguished from the latter, however, by having no angle on the third segment of the antennæ. The colour of the legs is different and the spines on the hind tibiæ are not so distinct. The abdomen in this species is darker in colour and more distinctly banded.

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## XXVII.—*Two new Species of Nasua.*

By OLDFIELD THOMAS.

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### *Nasua candace*, sp. n.

Allied to *N. dorsalis*, but the black dorsal line scarcely defined.

Size about as in *N. nasua*, though the teeth are smaller. General colour above tawny ochraceous, a median darker area, 2–3 in. in breadth, extending from the nape to the base of the tail, but not forming a sharply defined black dorsal line as in *dorsalis*. Along this area the hairs are cream-buff basally, with tawny or ochraceous tips and black subterminal rings. Under surface brown, the tips of the hairs buffy, throat and chest cream-buff. Muzzle brown. Ears thickly hairy, blackish with white edges. Forearms pale buffy to the metacarpus; digits dark brown. Hind limbs smoky brown, some of the hairs, especially on the metatarsus, pale buffy. Tail heavily haired, completely ringed with black and pale buffy, about 7–8 rings present.



Skull very like that of *N. nasua* in size and the proportions of the muzzle. Nasal opening not showing evidence of a specially lengthened snout, as is the case in *N. vittata*. Palatal foramina oblong, pointed behind. Canines less broadened at the base than in male *N. nasua*. Molars conspicuously smaller than in that animal, as small as in *N. montana* and *quichua*.

Dimensions of the type (measured in the skin):—

Head and body 750 mm.; tail 470; hind foot 90; ear 31.

Skull: greatest length 130; condylo-basal length (c.) 122; zygomatic breadth 64; interorbital breadth 25·7; breadth of brain-case 43; breadth of muzzle behind canines 18·5; palatal length 80; front of canine to back of  $m^3$  46·3; breadth of canine at base 8; length of molar series 18·6;  $m^1$ , length 6·4, breadth 6·1.

*Hab.* Medellin, Antioquia, Colombia.

*Type.* Subadult male. B.M. no. 73.4.23.5. Collected by Mr. J. K. Salmon.

This *Nasua* has been many years in the Museum collection under the provisional name of *N. dorsalis*, but it may be distinguished from that animal by the greater length and diffusion of the darker dorsal area, which does not form a defined black line, and by the pale buffy forearms, these being dark rufous in the allied form. From all the members of the *N. nasua* group it is separable by its much smaller teeth.

*N. dorsalis* is a native of Peru and Ecuador, and the present species is a more northern representative of it.

### *Nasua manium*, sp. n.

*N. nasua* group. Premaxillæ short. Posterior back blackish.

Size about as in *N. nasua*. General colour above dark grizzled tawny, the posterior back black mesially. Under surface brown, dull whitish on throat, chest, axillæ, and inguinal region. Head greyish brown, without defined markings. Ears dark with light edges, a well-defined whitish streak on the sides of the neck below them. Arms and legs grizzled tawny, hands and feet dark brown. Tail rather short, black, with six lighter rings, which are narrow and more or less incomplete above, especially terminally.

Skull agreeing in size with that of *N. nasua*, but the nasal opening and premaxillæ are short, and the anterior palatine foramina are short, broad, and rounded, quite

different from the narrowed foramina of the other species. Canines less broad at their bases than in *N. nasua*. Molars large,  $m^1$  with a well-developed internal cusp.

Dimensions of the type:—

Hind foot (dry) 90 mm.

Skull: greatest length 130; condylo-basal length 120; zygomatic breadth 62; length of nasals in middle line 36; interorbital breadth 27; breadth of brain-case 47; palatal length 77; palatal foramina 5; front of canine to back of  $m^3$  46; length of molar series 21.3;  $m^1$ , length 7.7, breadth 6.8.

*Hab.* Balzar Mts., N.W. of Guayaquil, Western Ecuador.

*Type.* Subadult male. B.M. no. 80.5.6.78. Collected by Mr. Illingworth.

This is the representative of *N. nasua* in the coast country to the west of the Andes. The little *N. olivacea* is also found in Ecuador, as is the intermediate sized *N. quichua*, Thos.

# XXVIII.—Description of a new Desert-Lark from the Central Western Sahara. By ERNST HARTERT.

THE mountains and stony desert-tracts of the northern Sahara are inhabited by sand-coloured Desert-Larks which are now generally looked upon as races of *Ammomanes deserti*. Thus in the Algerian Sahara a reddish subspecies, *Ammomanes deserti algeriensis*, is common in suitable places. On the expedition to In Salah I found the latter as far south as about 30 kilometres north of El Golea, but after that it ceased entirely, and did not occur again until we came to the banks of the waterless Oued Saret, where it suddenly was in evidence again, but in a conspicuously different form, which I propose to name

*Ammomanes deserti mya*, subsp. n.,

after the River or Oued Mya, in the system of which we only found this bird.

This form does not much differ in colour from *A. d. algeriensis*, though it is generally less reddish, especially on the rump, and the tail-feathers are more blackish on the inner webs; but it differs considerably in size: wing of males 107–111, of females 97–101 mm., *i. e.* about 6–7 mm. longer than in *A. d. algeriensis*; tail about 74–76.5 mm. The bill

is much longer and thicker and generally of a brighter yellow.

The song is also different from that of the smaller northern form, and will be described elsewhere.

Type of *Ammomanes deserti mya*: ♂, no. 200. Oued Mya, 7. iv. 1912. In the Tring Museum.

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XXIX.—*New Species of Heterocera from Costa Rica*.—XVII.  
By W. SCHAUS, F.Z.S.

Geometridæ.

Subfam. *BOARMIINÆ*.

*Semiothisa lydia*, sp. n.,

♀. Body brownish grey, with some darker irrorations on abdomen. Wings greyish white, almost obscured by grey striæ, and some scattered black irrorations; lines grey-brown; medial line coarse, wavily dentate; postmedial fine, lunular dentate, closely followed by a broad dull shade of the same colour, reaching termen, but slightly mottled with ground-colour on termen at middle of outer margins. Fore wings: a fine antemedial line angled on subcostal; a dark streak on discocellular; some white mottlings at apex. Hind wings: a black discal point. Wings below whiter, mottled with grey-brown striæ; the veins yellow-brown; the lines dark brown; the postmedial lunular and the shade following it narrower; on fore wings the white ground-colour is partly shaded with yellowish. Outer margin of fore wing sinuous, of hind wing bluntly angled.

Expanse 26 mm.

*Hab.* Tuis, Sixola,

*Semiothisa delia*, sp. n.

♀. Very similar to *S. lydia*, Schs.; the outer margin of fore wing more deeply sinuous, of hind wing more sharply angled; ground-colour whiter, the markings all dark brownish slate-colour; the hind wings with medial line much broader, suffusing with striæ to near base. Underneath the same difference in colour is noticeable, and the veins are dark brown, not yellow-brown.

Expanse 28 mm.

*Hab.* Juan Vinas, Sitio,

*Apicia flexilis*, sp. n.

♂. Palpi and frons brown. Vertex grey. Collar grey, mottled with fuscous. Thorax and abdomen whitish buff, the latter irrorated with black dorsally. Wings whitish buff to outer line, then tinged with lilacine brown, thinly irrorated with black scales, partly connected by dark striæ, chiefly on hind wings; black discal points. Fore wings: antemedial line very fine and indistinct, outangled, marked by a darker point on subcostal; outer line from apex to middle of inner margin lilacine white, finely wavy, preceded by a dull green shade and some black in places; subterminal fuscous points between veins 3 and 4, and 5 and 6. Hind wings: a post-medial line near cell like outer line of fore wing; a faint subterminal lilacine line, preceded by a dull green shade. Wings below dull whitish; a subterminal broad brownish shade suffusing with greyish termen at apices and at tornus of fore wing. Fore wings heavily striated with brown; traces of a fuscous outer line; a black line on discocellular. Hind wings: some striæ on costal half; a black discal point.

Expanse 27 mm.

*Hab.* Carillo, Puriscal.

*Pyrinia rufinaria*, sp. n.

♂. Head purple-brown. Collar grey, irrorated with purple-brown. Thorax and wings reddish brown. Abdomen orange-brown. Wings with darker striæ; outer margins glossed with lilacine slate; outer line dark reddish brown, slightly wavy, outwardly shaded with slate. Fore wings: costa whitish grey, spotted with black, broadest on basal half; a reddish-brown medial line, angled at end of cell and inwardly shaded with slate; a black point on discocellular; the outer line expanding on costa. Wings below orange, striated with dark red. Fore wings: a medial purplish blotch at end of cell and one from cell to inner margin; the shading following outer line bifurcating at vein 3 to tornus. Hind wings: the outer line purplish; the termen shaded with red.

Expanse 28 mm.

*Hab.* Juan Vinas, Tuis, San Mateo.

*Metanema striolata*, sp. n.

♂. Antennæ pectinated. Head, collar, and thorax dull greyish brown. Abdomen brighter brown. Wings light



brown, with long darker brown striæ; fuscous discal points; lines fine, dark brown. Fore wings: antemedial line faintly angled on subcostal and submedian; a faint postmedial brownish shade, outcurved beyond cell; outer line subterminal, followed by a white point on costa, angled at vein 7, slightly sinuous. Hind wings: the subterminal line slightly sinuous. Underneath whitish buff, irrorated with grey-brown; the subterminal line fine, straighter; the discal points minute.

Expanse 31 mm.

♀. The lines darker, outwardly shaded with fuscous, especially the subterminal. The outer margins more sharply angled at vein 4.

Expanse 29 mm.

*Hab.* Juan Vinas.

Somewhat like *Anisoperas atropunctaria*, Wlk., but brown, and the outer line much nearer termen.

*Microgonia amicaria*, sp. n.

♂. Head and thorax brown. Abdomen above grey-brown. Fore wings: base brown, limited by the antemedial fuscous line, which forms three curves marked by grey points on median and submedian, by some dark grey shading on inner margin, and is preceded by some fine whitish lines on extreme costa; medial space fuscous brown; a black point at end of cell, faintly edged with dark grey; a postmedial outbent whitish line on costa to vein 7, then an inbent series of whitish points on veins connected by an indistinct lunular fuscous line; a large light brown and whitish subterminal spot on costa, crossed by black striæ and outwardly edged with white; a subterminal, fine, interrupted, dentate, fuscous line. Hind wings brown, the basal half shaded with fuscous; the postmedial line with the points less distinct; some black striæ on outer half and traces of subterminal line. Wings below pale brownish grey, with fine black striæ and irrorations; black discal points; a postmedial fuscous line, followed by a broad brown shade not reaching termen.

♀. Thorax and wings richer brown, the lines more distinct, heavier, grey; the subterminal fuscous, partly shaded with grey. Fore wings: a large round grey spot at end of cell containing a black point; the medial space only slightly darker; the subterminal costal spot more heavily edged with white; some scattered white irrorations. Hind wings: grey and whitish irrorations near lines and along inner margin; a small round grey discal spot containing a black point. Wings below as in male, the termen whiter.

Expanse, ♂ 51, ♀ 50 mm.

*Hab.* Juan Vinas.

*Oxydia obtusaria*, sp. n.

♂. Palpi and head brown. Collar and thorax yellow-buff. Abdomen and wings buff-grey, faintly tinged with lilacine and with scattered black irrorations. Fore wings: a fine brown antemedial line, outcurved in cell; outer line dark brown, more heavily marked except on costa, angled just below vein 7, and inbent to inner margin beyond middle, followed by a dentate fuscous shade from veins 7-2; a black point at end of cell. Hind wings: a medial fuscous line. Wings below darker, browner, more thickly irrorated with black; black discal points; a broad postmedial pale reddish-brown shade and faint traces of the lines.

Expanse 48 mm.

*Hab.* Juan Vinas, Poas.

Allied to *O. platyptera*, Gn., but the falcate apex short and blunt; it is a variable species in colour, and the outer line is sometimes followed by whitish spots at veins 2 and 3.

*Certima annaria*, sp. n.

♂. Body light brown, the collar and thorax darker, mottled with lighter scales. Wings light brown, palest on medial space, striated with reddish brown to outer spots and on termen with fuscous brown. Fore wings: antemedial black and grey points on veins, followed by a dull olive-brown shade; a postmedial reddish-brown dentate lunular line, inbent, so the medial paler space is very narrow on inner margin; an outer row of black and grey points on veins, slightly inset on veins 5, 2, and submedian, connected by a dull greyish-brown shade; cilia with small dark brown spots at veins. Hind wings: a reddish-brown medial line; the outer spots outcurved, also connected by a broad dull greyish-brown shade; cilia tipped with grey. Wings below yellowish, with a few dark striæ; dark streaks on discocellular; a broad subterminal dark purplish-brown fascia, expanding to termen between veins 4 and 5 on fore wing and vein 4 to fold on hind wing.

Expanse 36 mm.

*Hab.* Juan Vinas.

*Isochromodes bellona*, sp. n.

♀. Body light brown; a black dorsal tuft at base of abdomen. Wings light brown, with a few scattered black striæ and irrorations; black discal points; cilia with black spots, the largest at veins 2 and 3. Fore wings: antemedial small

dark brown spots on veins, the one on submedian a little larger and preceded by some grey scales; a postmedial reddish-brown shade, linear from vein 3 to inner margin; an outer row of small black spots, close to postmedial from vein 3, followed from below vein 4 by a dark grey and black shade; a black spot at apex; a subterminal black spot below vein 3 and a terminal wavy black mark from just above 4 to vein 2. Hind wings: inner margin medially shaded with reddish brown, followed by irregular black markings to anal angle. Wings below buff, with a few dark irrorations; black discal points; the outer spots in a straighter line and followed by a broad fuscous shade.

Expanse 26 mm.

*Hab.* Juan Vinas.

Near *I. brumosa*, Dogn.

*Therina silanaria*, sp. n.

♀. Palpi, body, and fore wings slate-grey. Head yellowish. Fore wings: a black point on discocellular; a fine whitish outer line from below costa, outcurved and inbent to near middle of inner margin, interrupted and consisting partly of whitish striæ, increasing on inner margin; a small white spot striated with grey near apex. Hind wings light silky grey.

Expanse 33 mm.

*Hab.* Poas.

*Therina? perpectinata*, sp. n.

♂. Antennæ with exceptionally long pectinations finely ciliated. Head and thorax olive-black; some reddish-brown scales on vertex. Fore wings silky olive-brown; a black point at end of cell; a fine outer black line, vertical on costa, then slightly outcurved; a small subterminal yellow spot between veins 7 and 8. Hind wings dark silky grey; a minute black point on discocellular. Underneath dark silky grey, with black discal points.

Expanse 40 mm.

*Hab.* Ojo de Agua.

*Macrolyrcea sceva*, sp. n.

♂. Body and wings dark olive, the wings shaded with silky grey except between medial and outer lines. Fore wing: a fine wavy subbasal line, dark olive; antemedial dark olive, outbent on costa, angled in cell, inbent and slightly

wavy; medial line angled beyond cell, suffusing with the dark olive postmedial space, which is limited by a slightly sinuous, fine, lilacine line; an elongated pale buff space, striated with olive-brown on costa, preceding the outer line; a dark olive shade on outer margin from vein 5 to termen above tornus. Hind wings: the medial dark shade very narrow; the postmedial line nearly straight, barely visible; some scattered fuscous striæ on outer half. Wings below olive-brown, thickly striated with buff-grey; the fore wing with costa whitish; the termen broadly clear dark olive-brown, and a straight subterminal white line; a dark streak on discocellular; hind wings with scattered black irrorations and a very indistinct outer line, nearly straight.

Expanse 46 mm.

♀. Body and wings buff-brown, the latter with darker shades and striæ; antemedial line lunular on costa.

Expanse 50 mm.

*Hab.* Poas.

Near *M. nondina*, Dr.; differs in colour, in the absence of black discal points, and in having the medial and outer lines closer together. *M. nondina* has the postmedial line on hind wings distinct and sinuous both above and below.

*Alcis herse*, sp. n.

♂. Palpi and frons black mottled with grey. Vertex grey; a black line between antennæ. Collar, thorax, and abdomen light grey, thinly irrorated with black; a transverse black line at base of abdomen and pale buff segmental lines. Wings white, with a few dark irrorations. Fore wings: costa, base, and termen shaded with grey; dark striæ on costa and fuscous spots at origin of lines; a fine subbasal shade; a fine black antemedial line, inbent below cell, preceded by a curved greyish shade; a greyish spot at end of cell, edged by a fine fuscous line; a fine medial line, outcurved around discocellular; postmedial fine, remote on costa, vertical at first, bluntly outcurved across vein 5, then sinuous and incurved, approximating medial line from veins 4 to 3, and from fold to inner margin, followed throughout by a brownish shade; subterminal white, finely lunular; dark marginal points on interspaces and a fine terminal black line. Hind wings: a black line at base; medial line fine, black, sinuous, heaviest on inner margin; a semilunar outlined spot at end of cell; postmedial fine, wavy to below vein 6, then barely incurved, followed by a brownish shade; subterminal wavy, lunular. Wings below white. Fore wings: costa



heavily striated with black; a fuscous streak on discocellular; termen fuscous, narrowest at tornus, mottled with white between veins 3 and 4. Hind wings: a fine medial line from costa to discocellular; a narrow marginal fuscous shade from apex to near vein 4.

Expanse 31 mm.

*Hab.* Avangarez.

Sometimes the antemedial and postmedial lines on fore wings expand on inner margin into fuscous blotches.

*Aleis aglauros*, sp. n.

♂. Head, collar, and thorax dull brownish grey; a few brown irrorations on collar. Abdomen paler, with dark segmental lines. Fore wings pale brown, tinged with lilacine in cell and with whitish medially below cell and just beyond cell; some scattered dark irrorations and black striae on costa; a faint subbasal fuscous shade; antemedial fine, black, angled on subcostal, then slightly inbent, marked by a small black spot on median; a fine medial line, crossing a large greyish spot at end of cell and marked by dark points on median, vein 2, and submedian; postmedial fine, black, somewhat incurved on costa, bluntly angled across vein 5, then inbent, wavy; subterminal whitish, wavily dentate, preceded by a fuscous shade above and below vein 5, and there followed by dark streaks to termen; dark terminal points on interspaces connected by a lunular line. Hind wings whitish at base, otherwise pale brown; medial line fine, black, downbent towards inner margin; an oval dark line on discocellular; postmedial bluntly angled at vein 6, then incurved; subterminal more deeply dentate. Wings below pale brownish. Fore wings: a large fuscous spot at end of cell, and a similar subapical patch from below vein 5 to vein 9; traces of postmedial beyond cell; terminal points on interspaces. The hind wings immaculate.

Expanse 35 mm.

*Hab.* Juan Vinas.

*Aleis pandrosos*, sp. n.

♂. Head and collar grey; thorax whiter grey, with a few dark irrorations; abdomen grey, with whitish segmental bands. Fore wings grey-white, thinly scaled, with a few pale greyish striae and darker irrorations; terminal third shaded with pale greyish brown; costa pale brown, with dark striae and fuscous spots at origin of lines; a faint subbasal, straight, brownish shade; antemedial line fine, black,

minutely wavy and nearly vertical, preceded by a faint brownish shade; a large greyish spot over discocellular; postmedial line fine, fuscous brown, minutely wavy, vertical from costa to vein 5, then inbent, preceded from vein 2 to inner margin by a fuscous shade; fuscous streaks above and below vein 5 to near termen; a subterminal dentate whitish line, suffusing with a terminal whitish shade between veins 7 and 8; marginal small dark spots on interspaces. Hind wings: basal half whiter, with a few fuscous irrorations above and below cell; a medial brownish line, irrorated with black, geminate, followed by an oval line on discocellular; the postmedial fine, black, angled at discal fold, then incurved; the outer half brownish; a whitish line near postmedial; the subterminal white, more deeply dentate than on fore wing. Wings below dirty white; a broad marginal fuscous shade, not quite reaching termen; a fuscous spot at end of cell on fore wing.

Expanse 36 mm.

*Hab.* Sixola, Tuis, Juan Vinas, Guapiles.

*Nesalcis læca*, sp. n.

♂. Head olive-brown; a dark brown shade between antennæ. Thorax brownish grey. Abdomen brownish white; a fuscous line at base of abdomen and brownish segmental lines, interrupted dorsally. Wings dirty white, thinly irrorated with dark brown; an outer, slightly curved, fuscous-brown lunular line, outwardly toothed on veins; the veins pale orange-brown, interrupted before the subterminal, which is whitish, lunular; a faint brownish shade follows both the postmedial and subterminal; terminal fuscous-brown spots on interspaces; a small fuscous spot on discocellular. Fore wings: a fine fuscous antemedial line; a faint postmedial lunular dentate line, suffusing with outer line just below vein 2. Hind wings: a fine brown medial line. Underneath whitish; faint discal points; the outer line visible through wings; costa of fore wings yellowish striated with brown.

Expanse 35 mm.

*Hab.* Juan Vinas, Avangarez.

Smaller and less brilliantly coloured than *N. cræsaria*, Schs. = *regularis*, Dogn.

*Leucula cachiaria*, sp. n.

♂. Head black, thinly scaled with white. Body and wings

white, the latter thinly scaled. Fore wings: the edge of costa at base black; a fine medial smoky line, angled on subcostal and inbent to near base of inner margin; a black spot at end of cell; outer line from costa near apex to inner margin beyond middle. Hind wings: a smoky medial line followed by a black point on discocellular below vein 6; a subterminal smoky spot below vein 6 and one on inner margin. Fore wings below with a postmedial small black spot on costa.

Expanse 24 mm.

*Hab.* Cachi, Juan Vinas.

*Nipteria fronsaria*, sp. n.

♂. Palpi dark brown. Frons deep yellow; vertex, collar, and patagia whitish grey. Thorax and abdomen dark grey. Wings thinly scaled greyish white; veins brownish grey; discocellulars finely darker. Fore wings: an outer dark grey line from costa before apex to inner margin beyond middle, more heavily marked towards costa; the costal margin more heavily scaled and whitish; cilia white, tipped with dark grey. Hind wings: a faint darker postmedial line. Underneath white, the veins more heavily marked, especially on hind wings; the outer line well marked.

Expanse 24 mm.

*Hab.* Guapiles.

*Nipteria mitellaria*, sp. n.

♀. Palpi dark grey. Head and collar yellow; some orange-brown shading on vertex and collar behind. Thorax, abdomen, and wings grey, the wings thinly scaled. Fore wings: a darker grey medial shade, inbent on inner margin; a similar postmedial shade, slightly angled at vein 5; a darker grey line on discocellular. Hind wings: a subterminal darker grey line.

Expanse 31 mm.

*Hab.* Tuis.

*Astyochia lachesis*, sp. n.

♂. Palpi dark brown. Head, collar, and patagia yellow. Thorax and abdomen greyish buff. Wings whitish grey; veins, lines, discal spots, and some terminal striæ fuscous grey; cilia white, shaded with grey at veins. Fore wings: antemedial inbent from subcostal; subcostal and median

darker from near base to just beyond antemedial ; outer line outcurved, irregular. Hind wings: discal spot large ; outer line outcurved ; the termen of both wings rather more heavily scaled. Underneath whiter, the lines duller.

Expanse 27 mm.

Hub. Tuis.

[To be continued.]

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XXX.—*A new Species of Tabanus from German East Africa, in the British Museum (Natural History).* By ERNEST E. AUSTEN.

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*Tabanus trianguliger*, sp. n.

♀.—Length (22 specimens) 13·6 to 16 mm. ; width of head 5 to 5·6 mm. ; width of front at vertex 0·8 to 1 mm. ; length of wing 12 to 13·4 mm.

*Dusky species (dorsal surface of abdomen in rubbed specimens more or less cinnamon-rufous), with upper surface of body bearing conspicuous, light-grey markings ; front moderately broad and of uniform width ; dorsum of thorax longitudinally striped with grey ; dorsum of abdomen bearing three longitudinal series of large, smoke-grey or drab grey triangles, so that the ground-colour is reduced to a minimum ; wings faintly tinged with drab, almost hyaline ; femora pale (greyish fawn-coloured or greyish ochraceous buff), inner surfaces of front pair more or less dark brown.*

*Head:* subcallus pale cream-coloured pollinose ; face, jowls, and basioccipital region whitish pollinose and clothed with white hair ; occiput light grey pollinose ; front smoke-grey, clothed with short, yellowish hair, but with a darker, black-haired patch on vertex, and a similar patch in the middle ; front (estimated by eye) about four times as long as its breadth at lower extremity, inner margins of eyes bordering it parallel or only very slightly convergent below ; frontal callus rather large, dark brown, not very shining, roughly quadrate in shape but with its angles (at least the upper pair) rounded off ; traces of a second, similarly coloured, elongate (more or less elliptical) callus are usually distinguishable in the centre of the median dark patch ; proximal joint of palpi greyish cream-buff, clothed with



white hair, terminal joint cream-buff, acuminate, moderately swollen at base, thickly clothed on outer side with appressed, glistening silvery-white hairs, usually mixed with some minute black hairs; first and second joints of *antennæ* greyish ochraceous-buff, clothed with glistening silvery-white hairs (the upper distal angles clothed with minute black hairs), expanded portion of third joint cinnamon-rufous or ochraceous-rufous, often more or less brownish or dark brown towards distal extremity, relatively short, annulate portion of third joint clove-brown, relatively long. *Thorax*: dorsum dark brown (in rubbed specimens appearing more or less slate-grey), marked with five light-grey, partly yellowish-, partly whitish-haired longitudinal stripes; anterior and lateral borders of dorsum also grey; outer surface of each postalar callus, and a narrow area immediately in front of this above base of wing, clothed with white hair; median dorsal grey stripe very narrow, starting on front margin but terminating before reaching prescutellar groove; admedian dorsal grey stripes broad and entire, starting on front margin and meeting at tip of scutellum, which their distal extremities encircle; lateral grey stripe on each side short, extending only from outer extremity of transverse suture to postalar callus; dark stripes between grey stripes clothed with blackish hair; distal extremity of scutellum cinnamon-rufous or ferruginous; swelling in depression at each end of transverse suture drab-grey; pleuræ and pectus light grey, clothed with whitish hair, upper portion of mesopleuræ drab-grey, clothed partly with whitish, partly with blackish or black hair. *Abdomen*: tergite of first segment with a large drab grey patch on each side, and on hind margin in middle line with a small, somewhat triangular or transversely elongate spot, similarly coloured and clothed with yellowish hair; in the centre of the segment is a dark brown blotch (somewhat greyish in front, where it projects from beneath the scutellum) extending to the hind margin; the distal edge of this blotch is indented by the median light spot or triangle already described, and its sides are concave; each of the lateral drab-grey patches bears an oblique streak or patch of minute black hairs, extending outwards towards the posterior angle; tergites of second to fifth segments inclusive each bearing three large drab-grey triangles, arranged in a transverse row (thus forming also three longitudinal series), resting on the hind margin, where they are usually though not always connected, and extending to the front margin; the outer triangles are right-angled or obtuse-angled, the right angles or obtuse angles being the

inner ones on the hind margins of the segments ; those of the median series are acute-angled, though their apices are truncate and, in the case of the median triangles on the second and third segments, usually clongate ; the sides of the median triangles on the second and third segments are also more or less concave ; lateral margins of second and following segments, which cut off the outer angles of the outer series of triangles, drab-grey or buff ; tergite of sixth segment with more or less distinct traces of the three triangles seen on preceding segments ; basal angles of tergite of second segment drab-grey ; basal angles of tergite of first segment, and lateral margins of this and of the five following tergites, clothed with whitish hair ; all drab-grey triangles clothed with minute, appressed, yellowish hairs ; intervening dark brown or mummy-brown markings clothed with minute, appressed, black hairs ; tergite of seventh segment clove-brown (its sides and hind border buff), clothed with black hairs, which at each lateral extremity are usually mixed with yellowish hairs ; venter greyish salmon-coloured, when viewed obliquely from behind usually with traces of a narrow, dark, interrupted, median, longitudinal stripe, ventral scute of penultimate segment mouse-grey, that of terminal segment slate-grey, hind margins of ventral scutes of second to sixth segments inclusive cream-coloured ; ventral scutes of second to sixth segments inclusive clothed with appressed yellowish hairs, which in centre of ventral scute of sixth segment are mixed with longer black hairs, a few longer black hairs sometimes also present in centre of ventral scute of fifth segment ; ventral scute of seventh (terminal) segment clothed as usual with coarse, erect, black hairs. *Wings*: veins dark brown ; stigma pale and inconspicuous, usually faintly raw-umber-coloured. *Squamæ*: alar pair of same colour as wing-membrane, but more opaque, their borders mouse-grey ; thoracic pair cream-buff, their borders somewhat deeper in colour. *Halteres*: knobs yellowish cream-coloured, more or less buff or orange-buff towards base, stalks buff or cream-buff. *Legs*: coxæ grey, clothed with white hair ; femora and tibiæ clothed with white or silvery-white hair, except inner surfaces of front femora and distal extremities of front tibiæ, which are clothed with black hair ; tibiæ buff or ochraceous-buff, distal extremities of front pair, to a greater extent on inner than on outer surface, dark brown, front pair also narrowly mouse-grey at extreme base ; front tarsi clove-brown, second, third, and fourth joints somewhat expanded ; middle tarsi dark brown ; hind

tarsi mummy-brown, last joint and tips of the three preceding joints dark brown.

German East Africa: type and eight other specimens (para-types) from a water-hole in the Usangu District, 26.xi.1910, and two additional specimens from the Uhehe District, 3000 to 3500 ft., 22-27.xi.1910 (*S. A. Neave*: presented by the Entomological Research Committee). In addition to the foregoing the following material, in possession of the Entomological Research Committee and also collected by Mr. S. A. Neave, has been studied: one para-type from the Usangu District, and ten other specimens from the Uhehe District—remaining data in each case as before.

In the shape of its frontal callus and upper frontal callus, as also in that of the terminal joint of its palpi, *Tabanus trianguliger* shows some affinity to *T. pallidifacies*, Surcouf, which hitherto has been found only in the (British) East Africa Protectorate. Apart, however, from its very different *facies*, due to the development of the grey abdominal markings into a triple series of broad triangles, as described above, *T. trianguliger* is distinguishable from *T. pallidifacies* by, among other characters, its front being distinctly narrower, and by the inner margins of the eyes bordering it being more regularly parallel, instead of somewhat divergent above. From *T. distinctus*, Ricardo, *T. trianguliger*, apart from its abdominal markings, may be distinguished at once by its broader front, and differently shaped (less elongate) frontal callus. From the *variatus*-form of *T. taniola*, Pal. de Beauv., the new species, apart from the greater development of its abdominal triangles, is distinguishable by the shape of its frontal callus and of the third joint of its antennæ, as also by its pale femora. It is scarcely necessary to add that in the foregoing comparisons the female sex is alone considered.

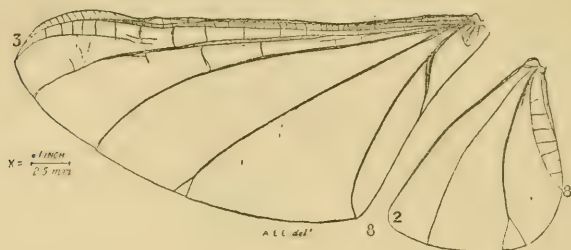
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XXXI.—On a new Species of Oligoneuria (Ephemeridæ)  
from British East Africa. By Rev. A. E. EATON.

*Oligoneuria dobbsi*, sp. n.

*Adult* (dried) ♀.—Wings transparent light blackish grey, with a faint dull violet-purple gloss and intense sepia-brown longitudinal neurulation; the cross-veinlets not bordered

(cf. text-figure). These are numerous (about 30) and straight in the marginal area, but are mostly concealed in the dried insect so far as the subcosta is overlain in the longitudinal



Neuration of *Oligoneuria dobbsi*, sp. n.

furrow in front of the ridge crested by the radius (3); the next three open areas contain respectively about 15, 7, and 5 cross-veinlets, of which many are obsolescent posteriorly, and are too delicate to be shown in the figure. The two subfiliform tails terminating the narrow membrane incurrent along the posterior edge of the mesonotum or scutellum from the roots of the fore wings seem long enough to reach the base of the third abdominal segment. Head, body, fore legs, and the stout portions of the hinder legs pitch-brown; head opaque; thorax and dorsum lucid; venter pallid; tabescent hind tibiae and tarsi impure whitish. Abdomen tapering posteriorly; segments nos. 6, 7, and 8 longer than those anterior to them, of which the posterior lateral angles (if not rectangular) are produced into only very short, inconspicuous, tooth-like points; but in segments nos. 8 and 9 the points produced are spiniform. Setae broken off when captured. Egg-masses lutescent, pale. Subanal lamina of the tenth segment narrow, shrunken troughwise in the dried insect, and produced on each side posteriorly into a broad-based, short, subulate spine.

Length of body about 20, of fore wing 25 mm.

Prep. Etn.; wings in Ca. balsam, mounted without pressure, detached from the pinned type-specimen (Brit. Mus. Nat. Hist.).

*Hab.* Sotik Post (alt. 6000 feet), Lumbwa District, British East Africa: one adult fly, captured at night in a house half a mile from the river Nyangoris, 22. viii. 1911 (*C. M. Dobbs*).



XXXII.—Some new Species of *Ipidae* and *Platypodidae* in the British Museum. By Lt.-Col. WINN SAMPSON, F.E.S.

THE first two species described are from specimens received through Mr. Guy Marshall from Mr. Urich, and found on cacao-plants in Trinidad. The only other specimens of *X. urichi* in the British Museum are two received in 1905 from Angola (Portuguese West Africa), and reported as damaging the cacao-plants there, but whether to a serious extent is not stated.

*Amphicranus theobroma*, sp. n.

Oblongus, nitidus, glaber, piceo-brunneus; prothorace lateribus subrecto, a triente antico in apicem constricto, supra ad apicem oblique rotundatim declivi, asperato; summo antico tuberculo minuto ornato; elytris vix conspicue punctatis, post medium oblique excavatis, ad apicem breviter productis, anguste divaricatis, margine excavationis utrinque dentibus tribus ornato, tertio majore prope apicem, exstructo.

Long. 2·5, lat. 0·9 mm.

*Hab.* Trinidad.

Near to *A. collaris*, Bldf., but smaller, with all the abdominal segments similarly coloured and with a prominent single tubercle on the centre of the prothoracic anterior edge, which is bisinuate, with the base truncate; the exposed portion of the mesonotum above the scutellum strongly punctured; anterior tibiæ very strongly toothed on the outer edge and having the inner edge sinuous and hairy; femoral lobe large.

*Xyleborus urichi*, sp. n.

Oblongus, prothorace semielliptico, gibbo, summo apice medio granulis prominulis notato, dorso postice punctato; elytris a basi ad medium valde nitidis, æque pulvinato-convexis, dense striato-punctatis, et interstitiis irregulariter punctatis: sed a medio ad apicem opacis, subtilissime granulatis, interstitiis tuberculis pilisque ornatis.

Long. 3·0 mm.

*Hab.* Trinidad.

Head ferrugineous, retracted, slightly convex, and evenly rugulose-punctate, with a straight transverse row of pale yellow hairs anteriorly; eyes oblong and emarginate, with

coarse facets; antennæ pale ferrugineous; prothorax ferrugineous and shiny on the posterior half, gibbose and semi-elliptical, slightly longer than broad, base truncate, with posterior angles acute, anteriorly rugose, with 4-6 prominent tubercles on the extreme anterior margin, the rugosity decreasing to the middle, the posterior half shiny and punctate, and the whole surface slightly pubescent. Elytra the same breadth as the prothorax and one-half longer, the posterior half parallel-sided and thence decreasing to form a somewhat acuminate apex, longitudinally arched from base to apex, with the basal third ferrugineous and shiny; punctate-striate, with the interstices irregularly punctured and piliferous; the apical portion dark and opaque, the interstices becoming tuberculate in the centre, with a double row of pale hairs, the remainder of the surface being very finely shagreened; a slight sinuosity and depression of the interstices near the suture is evident towards the apex; the under surface of the body uniformly coloured, except the abdominal segments, which are slightly darker, sparsely hairy, and coarsely punctured; the anterior coxæ contiguous, and the legs the same colour as the prothorax.

This species is near *X. capucinus*, Eichh., but differs in being narrower and longer, with punctate striæ on the elytra, the sides of which are not rounded from base to apex, &c.

*Xyleborus arquatus*, sp. n.

Oblongus, subnitidus, thorace semielliptico, antèrius rugis transversis scabro, posterius subtiliter punctulato, lineola media basali dense hirta; elytris striato-punctatis, interstitiis uniseriatim punctulatis, lateribus subparallelis.

Long. 2.5 mm.

*Hab.* Ceylon.

Compact in shape, with pale ferrugineous head and elytra pitchy black; head convex in front, the surface minutely and uniformly shagreened, sparsely hairy towards the front, with a row of pale hairs over the mouth; eyes transverse, black and emarginate; antennæ the same colour as the head; prothorax a dirty yellow, semielliptical, and as broad as long, with sides and posterior angles rounded, rugose, but not tuberculate, slightly hairy, obsoletely asperate behind, gibbose, with a small tuft of yellowish hairs at the centre of the base; scutellum small and dark-coloured; elytra one-half as long again as the prothorax, with subparallel sides, and obtusely rounded at the apex, slightly rounded at the basal angles, longitudinally arched from base to apex, striate-punctate,

with rows of longish hairs ; interstices with uniseriate rows of punctures and shorter hairs ; under surface dark, slightly hairy, and sparsely punctured ; legs paler than the body, the anterior tibiæ long and narrow, enlarged towards the apex, with a few strong teeth on the outer edge.

This insect has been received from Mr. E. Green, who reports it as a troublesome pest on the camphor-trees in Ceylon, where it is found both on the living and dead branches.

*Xyleborus niger*, sp. n.

Oblongus, niger, nitidus, pilis fulvescentibus parce adpersis, thorace gibbo, semielliptico, dorso antice exasperato, posterius subtiliter punctato ; elytris latitudine thoracis et illo vix duplo longioribus, subtilissime lineato-punctatis, interstitiis uniseriatim punctatis, apice a medio excavato-retuso, punctato, excavationis fundo nitido, lineato-punctato ; sutura vix elevata et piliferis tuberculis ornata, interstitiis uniseriatim punctatis, 3<sup>o</sup> et 4<sup>o</sup> tuberculis ornatis, margine apicali integro.

Long. vix 6 mm.

*Hab.* Ruby Mines, Burmah.

Head black, sparsely covered with piliferous punctures, the hairs very long, especially centrally ; there is a transverse fringe of long yellow hairs over the mouth, and anteriorly a central small shining depression with a slight longitudinal carina posteriorly, the general surface shagreened ; prothorax semielliptical, shiny black, rugose-asperate in front, interspersed with longish hairs, gibbous, with scattered piliferous punctures behind and a medial posterior group of pale hairs ; scutellum triangular and polished.

Elytra nearly twice as long as the prothorax, with subparallel sides and excavate from the middle, punctate-striate, the punctures being large, round, and shallow ; the interstices before the declivity are smooth, with small uniseriate piliferous punctures down the centre ; at the commencement of the declivity each interstice has a sharp tooth, with one or two longish hairs close to it ; interstices 3 and 4 also have a few teeth distributed along them towards the apex ; the sutural striæ have a single row of small tubercles after the commencement of the declivity.

This species belongs to Eichhoff's division \*\* of the genus *Xyleborus*, but is larger than any described by that author.

*Xyleborus sphenos*, sp. n.

Elongatus, subcylindricus, brunneo-testaceus, subnitidus, antice

rugulosus, postice parce subtilissime punctulatus; elytris supra subtilissime striato-punctatis, interstitiis ante declivitatem non tuberculatis, apice acuminatis, singulo lateribus seriatim tuberculato, sutura immuni.

Long. 2 mm.

*Hab.* Uganda.

Head, prothorax, antennæ, and legs testaceous; elytra dark; the eyes deeply and broadly emarginate; prothorax bluntly rounded anteriorly and decreasing in breadth towards the base, rugose in front, but shiny and smooth behind; elytra very faintly striate-punctate and gradually narrowing to the acute apex, which is lengthened by two blunt broad processes, being continuations of the second elytral interstices; the declivity (commencing from the apical third of the elytra) has the first two striæ toothed at the commencement and then tuberculate to the apex, and the edge of the declivity is provided with numerous teeth, increasing in size towards the apex.

In one very pale (immature) specimen the only dark portions are the eyes and the elytral declivity.

These insects were sent me with the specimens of *X. industrius*, but I am not certain as to whether they were captured at the same time.

*Xyleborus industrius*, sp. n.

Elongatus, cylindricus, pallide villosus, thorace testaceo, antice imbricato exasperato, postice punctato; elytris striato-punctatis, interstitiis subtiliter uniseriatim punctulatis, apice a parte tertio abrupte excavato-truncato, ambitu calloso dentibus pluribus minimis ornato, fundo ipso irregulariter punctato, sutura vix elevata, tuberculis pilisque ornata.

Long.  $3\frac{1}{2}$  mm.

*Hab.* Uganda.

Head and thorax testaceous; elytra dark except basally and laterally; head asperate, with scattered pale pubescence; eyes very deeply and broadly emarginate; prothorax oblong-cylindrical and slightly longer than broad, anteriorly roughened and hairy, the posterior part thickly covered with piliferous punctures; scutellum pale but well defined; elytra punctate-striate with very short hairs, the interstices having a single row of punctures with long hairs; after the declivity the hairs are continued only along the sutural striæ to the apex; the apical third of the elytra is somewhat abruptly truncate, forming a shiny very slight excavation with large shallow irregularly placed punctures, the margin



being edged with numerous small tubercles (two rather larger ones near the apex) and long pale hairs; the sutural striæ have a single row of tubercles extending to the apex, of which one or two near the apex are larger than the others.

Judging from Dr. Hagedorn's description, this species is somewhat similar to his *X. fisheri*, but differs in size, colour, arrangement of the tubercles, want of the suture between the pronotum and prosternum, &c.

Although here treated as a separate species from *X. sphenos*, I am of opinion that when more material comes to hand this insect will prove to be the female of the former.

*Crossotarsus fragmentus*, sp. n.

Brunneus, fronte plana, profunde punctata, medio fossulata; prothorace quadrato, parce irregulariter punctato, sulco brevi haud profundo; elytris lineato-punctatis, lineis ad basin impressis, interstitiis planis tenuiter lineato-punctatis, apice declivi, convexo, striato, interstitiis elevatis, seriato-tuberculatis et pilosis, margine externo utroque postice profunde emarginato, apice triplice emarginato.

Long. 5.5 mm.

*Hab.* Singapore.

Shiny brown, front flat, deeply punctured and sparsely hairy, with a small indentation in the centre and a dark median line at the top; prothorax with graduated punctuation, becoming coarser laterally, median line slight and scarcely reaching the base, with no groups of punctures; elytra with faintly punctured lines, the interstices shiny to the declivity and then contracted and bearing series of piliiferous tubercles, the base of the third interstice having a small group of punctures.

This handsome insect belongs to the *Crossotarsi subdepressi*, and seems nearly allied to *C. terminatus*, Chap., and *C. venustus* ♂ as described by Mr. Blandford (Ann. & Mag. Nat. Hist. ser. 6, vol. xv., April 1895). The elytral sculpture is somewhat complex, as will be seen from the figure (fig. 1, p. 250) of the apical half of the elytra, there being a deep lateral emargination on each elytron posteriorly and a triple emargination common to both elytra at the extremity; the interstices 1-3 cease a short distance before the apex, where the surface becomes smooth and shiny.

*Crossotarsus fractus*, sp. n.

*C. fragmento* similis, sed differt magnitudine et apicis elytrorum excisione minus profunda.

Long. 4.3 mm.

*Hab.* Borneo: Kuching, Sarawak.

This species also belongs to the *Crossotarsi subdepressi*, and only differs from *C. fragmentus* in size and in the elytra being less excised at the apex (fig. 2).

Fig. 1.



Fig. 2.



Fig. 1.—*Crossotarsus fragmentus*, sp. n.

Fig. 2.—*Crossotarsus fractus*, sp. n.

### XXXIII.—*On new Species of Histeridæ and Notices of others.* By G. LEWIS, F.L.S.

THE last paper on this family by me was published in July 1911; the present is the thirty-eighth of the series.

In all the papers, when referring to the genera *Trypanæus* and *Trypeticus* I have wrongly assigned the masculine forms to the female and the female to the male. Marseul and other writers have committed the same error. In 1853, when Marseul first began the study of the group he described the sexes as species, and although warned by Monsieur A. Sallé, who had seen the insects in their natural habitat, he was not convinced of the truth of the matter.

The doubt having arisen as to the sexes of *Trypanæus* and its ally *Trypeticus*, specimens were sent to Dr. Sharp for his opinion, and he, having dissected them, reported that the sexes have hitherto been reversed by describers. In order to

make this doubly certain, other specimens were sent to Mr. F. Muir in Honolulu, who has examined them thoroughly; his results are given in the following note and drawings:—

“The large *Trypanæus thoracicus* (marked ♂) is a female; the spermatheca is globular, large, and chitinized. I then opened up the *T. ensifer* and *Trypeticus* marked ♀, and found them both to be males. I have therefore not opened the specimens marked ♂. They are both of the Histerid type, but very feebly chitinized. *Trypanæus* is much larger, and the last abdominal segment (hidden beneath pygidium) is simple, while in *Trypeticus* the last abdominal segment is complex, with a pair of lateral struts and a large median plate (all chitinized invaginations of the last segment and not phallic). *Cm* 2 is very long in these two forms, and the ædeagus can be drawn into the abdomen a long way, and one is apt to destroy it if one tries to only take off the last segment of abdomen.

“*Trypeticus fagi* (figs. 1 & 2).—The last abdominal segment lies under the pygidium, the lateral edges being extended forward into the abdomen as two small struts (*d*); immediately within the segment is the usual ‘cloaca,’ with the anal opening on the dorsal face, and the ventral aspect extending into the abdomen as the second connecting membrane (*cm* 2) which connects the base of the ædeagus to the body-wall. In this case this membrane is of great length and allows the ædeagus to be withdrawn into or thrust out of the abdomen to a great extent. From each side of the base of the connecting membrane there is a long, thin, chitinized strut running forward into the abdomen; from the ventral edge of the ‘cloaca,’ between these two struts, there are two thin semi-membranous plates: the upper one (*c*) is somewhat spindle-shaped in outline, and slightly more chitinized along the margin than in the middle; the ventral one is angular (*b*), and also more chitinized on the margin than in the middle. The two plates and the lateral struts have similar origin, viz. by the invagination of the base of the second connecting membrane; a section through the struts near their base shows them to be hollow, with chitinized walls, and the plates consist of two membranes closely applied together. The lateral lobes are long and slender, semi-chitinized except at the tips, the chitinization extending a little way down the cylindrical basal piece. The median lobe is long, slender, and cylindrical, and very slightly chitinized, with the median orifice at the apex. The basal piece is about one and a half times the length of the lateral lobes,

Fig. 1.

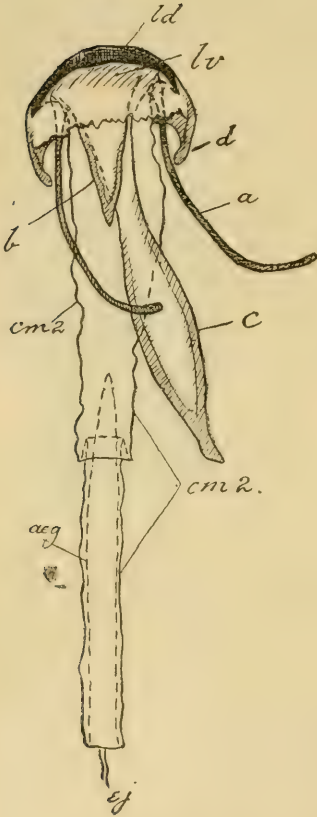
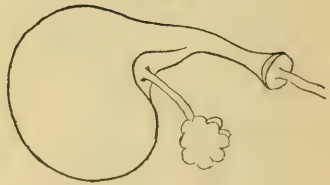


Fig. 4.



cylindrical and membranous, without any sharp line of demarcation at junction with the connecting membrane; there appears to be no specialized internal sac.

"*Trypanæus ensifer* (fig. 3).—The last abdominal segment, which is hidden under the pygidium, is of a simple nature, without any struts; the second connecting membrane, which is very long, joins directly on to the ventral plate, and sends out no struts or plates into the abdomen. The basal piece is cylindrical (*bp*), about two and a half times the length of the lateral lobes, membranous, with two lines more highly chitinized extending from the base of the lateral lobes to end of basal piece; the lateral lobes (*ll*) are sub-cylindrical, more highly chitinized than the basal piece except



Fig. 2

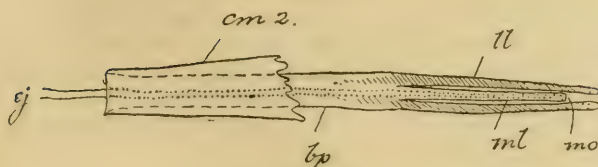


Fig. 3.

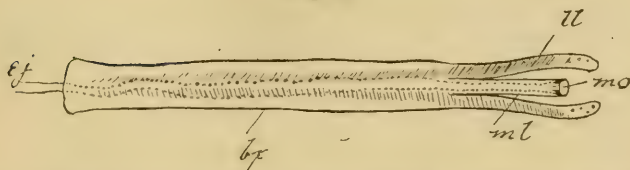


Fig. 1.—Last abdominal segment and ædeagus of *Trypeticus fagi* viewed from below. *ld*=last dorsal plate; *lv*=last ventral plate; *cm 2*=second connecting membrane; *aej*=ædeagus; *ej*=ejaculatory duct; *a* and *d*=struts; *b* and *c*=plates.

Fig. 2.—Ædeagus of *Trypeticus fagi*, Lew.

Fig. 3.—Ædeagus of *Trypanæus ensifer*, Mars.

Fig. 4.—Receptaculum seminis of *Trypanæus thoracicus*, Fabr., ♀.

at the tips; the median lobe is cylindrical, membranous, with median orifice at apex; the ejaculatory duct within the ædeagus is slightly enlarged and its surface bears 'herring-bone' striations.

"*Trypanæus thoracicus* (fig. 4).—The receptaculum seminis (spermatheca) is large, irregular flask-shape."

### List of Species.

*Hololepta umbratilis*.

—— *baulnyi*, Mars.

—— *vagata*.

—— *cavata*.

—— *curta*, Mars.

*Teretriosoma paratum*.

—— *stebbingi*, Lew.

*cristatum*, Lew., ♀.

*Plæsius acutidens*.

*Platylister habitus*.

*Ebisia exortiva*, Lew.

*Hister quadrimaculatus*, L.

*Pachycræus baconi*.

*Pelorurus fraudator*.

—— *densistriatus*.

*Discoscelis curvata*.

### *Hololepta umbratilis*, sp. n.

Oblonga, subdepressa, nigra, nitida; fronte bistriata, striis brevibus; pronoto lateribus anguste punctato; elytris striis 1 brevi, 2 interrupta; propygidio parce, in medio tenuiter punctato; pygidio vix dense punctato; tibiis anticis 4-dentatis.

L. 10 mill. (absque mandibulis).

Oblong, depressed, black and shining; forehead with two short transverse striæ; the thorax has a narrow band of lateral punctures sparsely set and not quite on the edge, the lateral stria passes the basal angle and also the anterior angle, the male has no emargination or fovea; the elytra, striæ, subhumeral rather wide and shortened before and behind, first dorsal basal and about one-quarter of the elytral length, second broken not far from the base; the propygidium is wholly punctured, but somewhat sparingly, and the points on the disc are smaller than those on the sides; the pygidium is somewhat densely punctured and the points are again smaller on the median area, the apex is narrowly smooth; the anterior tibiæ are 4-dentate, the two apical teeth have a common base.

The form of this species is distinctly oblong and like *Hololepta caracasica*, Mars., and *Lioderma pervalidum*, Blais.; it has the disc of the propygidium punctate, a characteristic seldom seen in either genus.

*Hab.* Argentina.

*Hololepta baulnyi*, Mars.

Marseul (Mon. p. 399, 1857) described the female of this species; the male has no carina on the mentum, the anterior thoracic angle is feebly notched, and the fossette is deep and oval and near, but not in, the angle.

*Hololepta vagata*, sp. n.

Oblongo-ovalis, depressa, nigra, nitida; pronoto lateribus parco punctulato; elytris striis 2 dorsalibus brevissimis, 1<sup>a</sup> appendiculata; propygidio toto sparsim punctulato; pygidio dense punctato.

L. 7 mm. (absque mandibulis).

Oblong-oval, depressed, black and shining; the forehead feebly impressed and without stria, mentum of the male is not carinate, mandibles slightly swollen in the middle, the vertex of the head has two small foveæ (doubtful as to being constant); the thorax, lateral margin with a band of rather fine punctures not densely set, anterior angle minutely notched, with a rather deep circular fossette close to the edge; the elytra, the outer basal stria has a short and straight apical appendage; the propygidium has scattered punctures, but at no point are the punctures close together, and the median area is almost free of them, apically there are two shallow impressions; the pygidium is closely punctate; the

prosternum is slightly constricted before the coxæ; anterior tibiæ 4-dentate.

This species differs chiefly from *cavata* in the mentum not being distinctly carinate in the male, in the form of the thoracic fovea, and in the punctuation of the propygidium.

*Hab.* Sukabumi (2000 feet), West Java.

*Hololepta cavata*, sp. n.

Oblongo-ovalis, depressa, nigra, nitida; pronoto lateribus sparsim punctulato; elytris striis 2 dorsalibus brevissimis, 1<sup>a</sup> appendiculata; propygidio circum punctato; pygidio dense punctato.

L. 8–8½ mill. (absque mandibulis).

Oblong-oval, depressed, black and shining; the head, surface with microscopic punctures, without striæ, forehead impressed, the mentum is very feebly carinate in the male; the thorax has a few lateral punctures chiefly in the anterior area, the anterior angle is not notched nor emarginate, but close behind the angle there is a shallow fovea almost circular in outline; the elytra has two basal striæ well-marked, the first having a short appendage; the propygidium has an external circle of punctures, the lateral points are the largest, but apically there are two clusters joining together, and here the punctures are most dense; the pygidium is densely punctate; the prosternum is slightly constricted before the coxæ; the anterior tibiæ are 4-dentate.

The general characters of this small species are similar to those of *baulnyi*, but the thoracic fossette in the male is different in form and position.

*Hab.* Ruby Mines, Burmah (*Doherty*).

*Note.*—Clean and bright specimens of *Hololepta curta*, Mars., *Hister curvatus*, Er., and *Scapomegas auritus*, Mars., are distinctly bluish, although they have all been described as black.

*Teretriosoma paratum*, sp. n.

Subcylindricum, cyaneum, nitidum, undique dense et fortiter punctatum, pedibus piceis; elytris transversim basi impressis; prosterno grosse punctato; mesosterno haud marginato, antice in medio obtuse arcuato; a metasterno leviter distincto; propygidio dense punctulato.

L. 2¾ mill.

Cylindrical, blue, shining, above rather densely and rather coarsely punctate; legs obscurely brown; the head closely

punctate, with an obsolete smooth spot on the vertex; the thorax is closely punctate outwardly and scarcely less so on the disc, marginal stria complete; the elytra are similarly punctate, with a transverse impression near the base; the pygidia, the punctuation is slightly finer than that of the elytra, the carina on the pygidium is well marked; the prosternum punctate, punctures smaller and less close anteriorly; the mesosternum is immarginate anteriorly and the metasternal suture is fine but visible, surface punctate; the metasternum is somewhat irregularly punctured, and the first abdominal segment is evenly punctate; the scape of the antennæ in ♂ is furnished with flavous hair.

This species is much less robust and smaller than *festivum*, Lew. (which measures  $3\frac{1}{4}$  mm.), and the surface punctuation is coarser and more dense, especially noticeable on the thoracic disc and on the scutellar region. The metasternal suture is not visible in *festivum*. Both species agree in the form of the mesosternum, anteriorly it is arched in outline, not acuminate.

*Hub.* Iatahy, Province of Goyas. Four examples.

*Teretriosoma stebbingi*, Lew. Ann. N. Hist. viii. p. 380 (1901).

♀. *cristatum*, Lew. l. c. p. 381.

After examining a series of the species, I find that the characters I relied on as being specific are sexual. I took the long palish hair on the scape of the antenna for a masculine character; the male has a pilosity, but it is much less conspicuous. Dr. Sharp has kindly made dissections of this species.

*Plæsius acutidens*, sp. n.

Oblongus, niger, nitidus; fronte distincte bistriata; pronoto stria marginali antice interrupta; propygidio margine antice anguste lævi, postice haud dense punctato; pygidio subconvexo parum transverso; prosterno haud striato.  
L. 10 mm.

Oblong, black and shining; forehead bistriate, surface with some fine punctures, mandibles sparsely punctulate, with a small but acute tooth on the inner edge; the thorax, marginal stria interrupted behind the head; the elytra, inner subhumeral stria shortened before and behind, outer very short and median, first dorsal apical and shortened before the middle 2-3 apical very short, punctiform or



obsolete; the propygidium has a narrow smooth margin anteriorly, otherwise it is punctate but not densely; the pygidium is very feebly convex and not very closely punctured; the prosternum is without striae; the mesosternum, stria interrupted behind the emargination; the femora are smooth.

The thoracic and dorsal striae are almost similar to those of *ellipticus*, Mars.; but *acutidens* differs in being oblong, the mandibles with a small acute tooth only, and the pygidium is very slightly convex and not very closely punctate. I have not seen an example of *ellipticus* with the first dorsal stria complete, as figured by Marseul, but his species is well-known and specimens are in most collections. *P. ellipticus* has the "pygidium bombé, deusement ponctué."

*Hab.* Isle of Batian (*Doherty*).

*Platylister habitus*, sp. n.

Ovatus, parum convexus, niger, nitidus; fronte concava; pronoto stria laterali haud interrupta; elytris striis 1-2 integris, 3 in medio interrupta; propygidio transversim punctato; pygidio margine haud elevato; mesosterno stria integra; tibiis anticis 4-dentatis.

L.  $4\frac{1}{2}$ -5 mill.

Oval, rather convex above, black and shining; forehead concave, stria fine, complete and nearly straight anteriorly; the thorax, marginal stria complete, parallel to the sides, slightly bent inwards at the basal angle; scutellar fovea clear but shallow; the elytra, first stria complete, second very slightly shortened at the base where the interstice is widest, third widely interrupted in the middle, apical portion longest but varying in length; the propygidium is irregularly transversely punctured in the middle; the pygidium is similarly punctate at the base and in the middle, but posteriorly the points are smaller and fewer, there is no rim; the prosternal keel is a little narrowed before the coxæ; the mesosternum, marginal stria complete, fine and close to the edge at the emargination but leaving it laterally; the anterior tibiæ are 4-dentate.

The form of the pygidium and of the mesosternal stria are good distinguishing characters for this species. *P. platypygus*, Mars., is seemingly similar, but the forehead of *habitus* is not concave nor punctate, and the stria is feeble, not strong.

*Hab.* Paumotu River, New Guinea (*Loria*). In the Genoa Museum and in my own collection.

*Eblisia exortiva*, Lew. Ann. Mus. Genova, vi. p. 636 (1888).

This species appears as an *Idister* in my catalogue of 1905, but as the tarsal grooves are not curved, it is well to place it in *Eblisia* until further revision of the genus is made.

*Hister quadrimaculatus*, L.

Herr H. Bickhardt has furnished this species with a twentieth name, one suggested by its superficial coloration. Not long since four other names were given on similar trivial characters, and I think that the multiplication of names of this kind is much to be deprecated.

*Pachycrærus baconi*, sp. n.

Oblongus, parum convexus, niger, nitidus; fronte punctata, stria integra; pronoto stria laterali antice interrupta; elytris striis 1-3 integris, 4-5 suturalique brevibus, margine apicali punctato; prosterno angustato bistriato, striis parallelis; mesosterno stria arcuata; pygidio vix dense punctato; tibiis anticis 5-dentatis.  
L.  $2\frac{2}{3}$ -3 mill.

Oblong, rather convex, black and shining; the forehead feebly convex, distinctly and somewhat closely punctured, stria complete and rather fine; the thorax punctured like the head except in the scutellar region where the points are finer, lateral stria rather near the edge and it ceases behind the eye; the elytra, apical margin punctate, dorsal striæ 1-3 complete, 4 dimidiate, 5 short not reaching the apex nor the middle of the disc, sutural shortened at the apex and reaching the disc, subhumeral very short and basal; the propygidium and pygidium are rather closely punctured, the latter is not smooth at the apex; the prosternum, the keel is narrow and the lateral striæ parallel; the mesosternum is obtusely acuminate anteriorly and the stria arched not marginal; the anterior tibiæ are 5-dentate.

This species is very similar to *P. verulamii*, Lew.; it is a little smaller and slightly narrower. Both have a narrow prosternal keel and the mesosternal stria of each is of similar outline. The punctuation of the head, thorax, and pygidium is very distinct in *baconi* and the thoracic stria is similar in both species, but the lateral margin is widest in *verulamii*.

*Hab.* Errer River, Abyssinia. Eight examples.

*Pelorurus fraudator*, sp. n.

Breviter ovalis, supra depressus, nigro-æneus, nitidus, elytris viridi-cæruleis, pygidio rufo; fronte depressa, punctulata, lateribus marginata; pronoto lateribus punctato; elytris striis 1-4 integris geminatis, 5 suturalique simplicibus; propygidio parce punctato; pygidio convexo, tenuissime punctulato; mesosterno bisinuato marginato; tibiis anticis 6-denticulatis.

L.  $4\frac{1}{2}$ - $5\frac{1}{2}$  mill.

This species is very similar to *glaucopterus*, Mars., from Natal, but the thorax has a wide antescutellar space smooth, the inner subhumeral stria is somewhat irregular and broken anteriorly, the fifth dorsal stria is single, with a short apical appendage parallel to it but not joined.

There are only ten species of this genus known and they all appear to be local and restricted in their distribution. The measurements given for this and *densistriatus* show that specimens vary much in size.

*Hab.* Beira (*A. P. Sheppard*); Matopos (*Guy A. K. Marshall*).

*Pelorurus densistriatus*, sp. n.

Breviter ovalis, supra depressus, niger, subopacus, pygidio apice obscure rufo; fronte punctulata; pronoto lateribus sat fortiter punctato, disco lævi; elytris striis 1-5 dorsalibus geminatis interstitiis striatis, suturali in medio furcata; pygidio apice utrinque compresso, punctato; prosterno lobo antico grosse punctato; tibiis anticis denticulatis.

L. 3-4 mill.

Oval, somewhat short, depressed above, black and a little opaque; the head, forehead impressed, surface punctulate and margined laterally; the thorax punctured at the sides, disc smooth, scutellar puncture bilinear, being divided in the middle, marginal stria complete, posterior rim punctured opposite the second and third dorsal striæ; the elytra, dorsal striæ 1-5 geminate but not very distinctly joined at the base, the outer pairs have interstitial striæ which render the true striæ less apparent; the sutural stria is not geminate, but it has a short branch on the discal area obliquely pointing outwards, the suture itself is finely marginate; the propygidium has punctures of varying sizes, which are largest and more close on the anterior half; the pygidium, the anterior portion is slightly convex and smooth, and from the middle of this area runs a smooth carina to the apical margin, on each side of the carina the pygidium is compressed, the surface distinctly punctured and obscurely red;

the prosternum, anterior lobe densely and coarsely punctured, keel with smaller and variously sized points less closely set, striæ widen out posteriorly (in one example the striæ are obliterated between the coxæ); the mesosternum is pointed like the keel, the marginal and the transverse striæ are crenate; the metasternum has a median furrow and a cluster of large punctures on each side at its base; the anterior tibiæ are denticulate.

The furcation or branch in the sutural stria is remarkable and also the fine marginal stria along the suture; it is not the ordinary sutural stria and the form of the pygidium is exceptional.

*Hab.* Harrar, Abyssinia (G. Christensen).

*Discoscelis curvata*, sp. n.

Oblongo-ovata, convexa, nigra, nitida; fronte tenuiter impressa, stria inconspicua; pronoto impunctato, stria marginali post oculos interrupta; elytris striis subhumerali interna basi abbreviata, 1-4 integris, 4 incurvata, 5 abbreviata, suturali dimidiata; propygidio vix grosse punctato; prosterno bistriato; mesosterno tenuissime marginato; tibiis valde dilatatis.

L.  $6\frac{1}{4}$  mill.

Oblong-oval, convex, black and shining; the head impunctate, slightly impressed in front, frontal stria very fine, almost obsolete; the thorax, surface smooth, lateral stria near the edge, continuing at the base as far as the first dorsal stria, anteriorly it is interrupted behind the eyes, but it is continued as a straight line behind the head, scutellar puncture small and shallow; the elytra, the inner subhumeral stria is a little shortened at the base, outer humeral is broken behind the middle, the dorsal striæ 1-3 are complete, 2 markedly turning inwards at the base, the fourth stria is complete and like the second turns in at the base and continues along it nearly to the suture, 5 apical and rather short, sutural apical and almost dimidiate; the propygidium is somewhat coarsely punctured, punctures somewhat irregular and not closely set, the points of the pygidium are smaller; the prosternum is bistriate, striæ widening out between the coxæ and are near together anteriorly; the mesosternum has a fine marginal stria which is straight anteriorly and not easily seen, behind the marginal stria is an arched stria clearly marked and common to it and the metasternum; the tibiæ are widely dilated.

I have assigned this species to *Discoscelis*, notwithstanding its large size.

*Hab.* Mar de Hespanha, Minas Geraes, Brazil.



XXXIV.—*Notes on Guiana Birds.* By LORD BRABOURNE, F.Z.S., M.B.O.U., and CHARLES CHUBB, F.Z.S., M.B.O.U., Zoological Department, British Museum.

IN the preparation of the List of the Birds of South America we have been allowed access to the very fine collection of British Guiana birds in the possession of Mr. F. V. McConnell, and in examining some of the species noticed the items mentioned below.

We have also to thank the Hon. Walter Rothschild for the loan of specimens which has helped us in the elucidation of some of the more difficult points.

We find that *Rhamphastos araçari*, Linn., is not applicable to the Guiana bird, as the author attributes it to the Brazilian species: *cf.* Syst. Nat. i. p. 104 (1758) (Brazil), ex Marcgrave. *R. atricollis*, P. L. S. Müller, Syst. Nat., Suppl. p. 83 (1776), was also founded on the Brazilian form, ex Buffon.

Wied appears to be the first author to recognize the true *Pteroglossus araçari* (Linn.), *cf.* Beitr. Naturg. Bras. iv. p. 283 (1831); and *P. wiedii*, Sturm, must be allocated as a synonym of *P. araçari* (Linn.).

The habitat of this species is Eastern Brazil, from Pará to Rio de Janeiro.

The Guiana bird therefore requires a name, for which we propose

*Pteroglossus roraimæ*, nom. nov. pro *Pteroglossus araçari*,  
auctorum (nec Linn.).

This species is most nearly allied to *P. araçari* (Linn.), from Eastern Brazil, but is distinguished by the broad black longitudinal band on the ridge of the culmen and the citron-yellow colour on the breast and abdomen, instead of the narrow black band on the culmen and the sulphur-yellow of the underparts, as in the Brazilian form.

The following notes have been compiled on a large number of examples of the *Thryothorus coraya* group of Wrens, which indicates four different races, or subspecies. *T. coraya* (Gmel.) was founded on Daubenton's plate, which bird was supposed to have come from Cayenne. Ridgway

accepted birds from British Guiana as typical, and named the French Guiana form *T. oyapocensis*.

Berlepsch, arguing that Cayenne was in French Guiana, concluded that Ridgway had named the wrong bird, and restricting *T. coraya* to the French Guiana (=Cayenne) form, named the British Guiana bird *T. ridgwayi*.

Reference to Daubenton's plate, however, proves Ridgway to be right, as, notwithstanding the locality "Cayenne," the French Guiana birds do not agree with Daubenton's figure; but British Guiana specimens collected at Roraima are almost identical in every detail; consequently we should select Roraima, British Guiana, as the type locality of *T. coraya* (Gmel.), notwithstanding the locality being given as Cayenne.

The series from Roraima would therefore be known as

*Thryothorus coraya coraya*.

A series of examples from Bartica Grove, British Guiana, however, differ from *T. coraya coraya* in the deeper chestnut colour of the back and the darker and duller fulvous on the chest and abdomen. This form we propose to name

*Thryothorus coraya berlepschi*, subsp. n.

The French Guiana birds must be called

*Thryothorus oyapocensis oyapocensis*.

We consider this form to be specifically distinct from *T. coraya*. Subspecies of this race, however, are existent, as a series from Ituribisci differ from *T. oyapocensis oyapocensis* in the darker coloration of the head, deeper chestnut of the back, and the more tawny colour of the abdomen. We propose, therefore, to separate this form under the name of

*Thryothorus oyapocensis ituribisciensis*, subsp. n.

We may remark also that we have examined a good series, both male and female, of the Bush-Shrike from British Guiana, which has been erroneously called *Thamnophilus major* by many authors, but we find it to be identical with *T. borbæ*, Pelzeln.

XXXV.—*Description of a new Cichlid Fish from the Lower Niger.* By G. A. BOULENGER, F.R.S.

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*Pelmatochromis arnoldi.*

Depth of body  $2\frac{1}{3}$  to  $2\frac{2}{3}$  times in total length, length of head 3 times. Head  $1\frac{2}{3}$  to  $1\frac{3}{4}$  times as long as broad; snout rounded, with concave upper profile, much broader than long, as long as the eye, which is  $3\frac{1}{2}$  times in length of head,  $1\frac{1}{3}$  to  $1\frac{1}{2}$  times in interorbital width, and slightly exceeds præorbital depth; mouth moderate, extending to between nostril and eye; teeth small, in 3 series, 60 to 70 in outer series of upper jaw; 3 or 4 series of scales on the cheek, width of scaly part equal to diameter of eye. Gill-rakers short, 9 on lower part of anterior arch. Dorsal XV–XVI 10–11, spines gradually increasing in length to the last, which measures nearly  $\frac{1}{2}$  length of head; median soft rays produced into filaments, as long as or a little longer than head. Anal III 8–9; third spine as long as or slightly longer than longest dorsal. Pectoral  $\frac{3}{4}$  to  $\frac{4}{5}$  length of head, not reaching origin of anal. Ventral produced into a filament, extending beyond origin of anal. Caudal rounded. Caudal peduncle a little deeper than long. Scales cycloid,  $28\frac{2\frac{1}{2}}{10-11}$ ; lateral lines  $\frac{19}{8-9}$ . Brownish or dark olive, with five indistinct dark bars and six large, blackish, round spots on each side, the first being the opercular spot; fins greyish, soft dorsal, anal, and caudal with small blackish spots.

Total length 90 mm.

Three specimens from the Lower Niger, presented to the British Museum by Mr. J. Paul Arnold, of Hamburg.

BIBLIOGRAPHICAL NOTICE.

*Memoirs of the Department of Agriculture in India. Entomological Series.* Vol. IV. No. 1. *Eri Silk.* By H. MAXWELL-LEFROY and C. C. GHOSH, Agricultural Research Institute, Pusa. Pp. 130, pls. ix., and 13 figures in the text. May 1912. Price Rs. 3.

THE *Eri* silkmoth is one of the closely allied species belonging to the genus *Philosamia* of Grote, of which *P. cynthia*, Drury, from Java, is typical. The present species, *P. lunula* of Walker, feeds on the castor-oil plant, and is largely reared for its silk in various parts of India. As the cocoon is open at the end, there is no occasion to

destroy the insect to obtain the silk, as is necessary in the case of the mulberry silkworm. The Eri silkworm is a much larger insect, and belongs, not to the family Bombycidae, like the mulberry silkworm, *Bombyx mori*, but to the Saturniidae, or Emperor Moths (one species of which is found in Britain), and is not very distantly allied to *Attacus atlas*, the largest known moth, which, like the Eri, is also an Indian species.

The present monograph gives us the full history of the Eri silkmoth in all its stages, illustrated, with elaborate instructions for rearing and for preparing the silk. It concludes with chapters on the castor-oil plant and on the Eri silk industry. We may add that the Eri silkmoth is very closely allied to the *Ailanthus* silkmoth, the cultivation of which Dr. Alexander Wallace attempted to introduce into England some years ago, with a moderate amount of success.

W. F. K.

### MISCELLANEOUS.

*A Review of South-African Land-Mollusca belonging to the Family Zonitidae.* By Lt.-Colonel H. H. GODWIN-AUSTEN, F.R.S. &c.

It was at first contemplated publishing the third and concluding part dealing with species of the Peltatinæ in the summer of this year. This has been found impossible, owing to insufficient data relating to two species—*corneus* and *poepigii*—and the doubtful identification of the shells of species dissected; this could not be settled until the types of these species had been seen. These are fortunately in the museum at Stettin. Dr. Heinrich Dohrn, to whom I recently wrote, has courteously promised assistance, but, owing to the collections in his charge being packed up pending transfer to new buildings, they cannot be got at until next winter.

Besides this, further spirit-specimens of some species are wanted from Natal; these Mr. H. C. Burnup will endeavour to obtain, but he tells me they cannot be secured until the right season comes round, viz. midsummer, so that very little more can be done in this family until we have entered on 1913.

*Errata in Dr. Ärnäck-Christie-Linde's paper in the 'Annals' for June 1912.*

Page 610, line 24, for the number of premolars read the number of upper premolars.

Page 611, line 9, for  $I_1 I_2 I_3 I_4 (C) P_1 P_2 (P_3) P_4$  read  
 $I_1 I_2 I_3 I_4 (C) P_1 P_2 (P_3) P_4 M_1 M_2 M_3$ .



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	Page
XVIII. Report on the Annelida Polychæta collected in the North Sea and adjacent parts by the Scotch Fishery Board Vessel 'Goldseeker.'—Part I. <i>Amphinomidae</i> to <i>Sigalionidae</i> . By WILLIAM SMALL, M.A., B.Sc., Gatty Marine Laboratory, St. Andrews. (Plate VI.)	165
XIX. Descriptions of new Batrachians from the Andes of South America, preserved in the British Museum. By G. A. BOULENGER, F.R.S.	185
XX. New or little-known Ethiopian Hemiptera. By E. BERGROTH, C.M.Z.S.	191
XXI. <i>Lygistorhina urichi</i> , a new Mycetophilid from Trinidad. By F. W. EDWARDS, B.A., F.E.S.	203
XXII. A new Vespertilionine Bat from Angola. By OLDFIELD THOMAS	204
XXIII. On a Species of <i>Nymphon</i> from the North Pacific. By FLORA M. SCOTT, M.A., University College, Dundee. (Plate VII.)	206
XXIV. A Revision of the South-American Siluroid Fishes of the Genus <i>Corydoras</i> , with a List of the Specimens in the British Museum (Natural History). By C. TATE REGAN, M.A.	209
XXV. Some Considerations in regard to the Classification of the Order Thysanoptera. By RICHARD S. BAGNALL, F.L.S., F.E.S., Hope Department of Zoology, University Museum, Oxford	220
XXVI. Entomological Notes from the London School of Tropical Medicine.—No. IV. Blood-sucking Diptera from Port Darwin, Australia. By SOPHIA L. M. SUMMERS, M.A., B.Sc., Carnegie Student of Aberdeen University	222
XXVII. Two new Species of <i>Nasua</i> . By OLDFIELD THOMAS	228
XXVIII. Description of a new Desert-Lark from the Central Western Sahara. By ERNST HARTERT	230
XXIX. New Species of Heterocera from Costa Rica.—XVII. By W. SCHAUS, F.Z.S.	231
XXX. A new Species of <i>Tabanus</i> from German East Africa, in the British Museum (Natural History). By ERNEST E. AUSTEN	240
XXXI. On a new Species of <i>Oligoneuria</i> ( <i>Ephemeridae</i> ) from British East Africa. By Rev. A. E. EATON	243
XXXII. Some new Species of <i>Ipidae</i> and <i>Platypodidae</i> in the British Museum. By Lt.-Col. WINN SAMPSON, F.E.S.	245
XXXIII. On new Species of <i>Histeridae</i> and Notices of others. By G. LEWIS, F.L.S.	250
XXXIV. Notes on Guiana Birds. By LORD BRABOURNE, F.Z.S., M.B.O.U., and CHARLES CHUBB, F.Z.S., M.B.O.U., Zoological Department, British Museum	261
XXXV. Description of a new Cichlid Fish from the Lower Niger. By G. A. BOULENGER, F.R.S.	263

#### BIBLIOGRAPHICAL NOTICE.

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#### MISCELLANEOUS.

A Review of South-African Land-Mollusca belonging to the Family <i>Zonitidae</i> . By Lt.-Col. H. H. GODWIN-AUSTEN, F.R.S. &c.	264
Errata in Dr. Ärnäck-Christie-Linde's paper in the 'Annals' for June 1912	<i>ib.</i>

\* \* \* It is requested that all Communications for this Work may be addressed, post-paid, to the Care of Messrs. Taylor and Francis, Printing Office, Red Lion Court, Fleet Street, London.

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[EIGHTH SERIES.]

No. 57. SEPTEMBER 1912.

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XXXVI.—*The Classification of the Blennioid Fishes.*  
By C. TATE REGAN, M.A.

(Published by permission of the Trustees of the British Museum.)

THE Blennioids may be defined as Percomorphous Teleosts with the pelvic fins jugular or mental, each of a spine and four soft rays or still further reduced, with the dorsal and anal rays typically corresponding in number to the vertebræ, each basal bone attached to its own neural or hæmal spine (rays more numerous in Ophidiiformes), with well-developed wings of the parasphenoid ascending in front of the prootics, and with all or most of the ribs inserted on strong parapophyses. The limits and contents of the group are indicated in the following scheme;—

### Order PERCOMORPHI.

#### Suborder BLENNIOIDEA.

1. *Blenniiformes*: Blenniidæ, Anarrhichadidæ, Congrogadidæ, Notograptidæ,
2. *Cliniiformes*: Clinidæ, Dactyloscopidæ, Xiphidiontidæ, Stichæidæ, Pholididæ, Lumpenidæ, Microdesmidæ, Ptilichthyidæ, Zoarcidæ, Seytalinidæ, Rhodichthyidæ.
3. *Ophidiiformes*: Brotulidæ, Ophidiidæ, Fierasferidæ,  
*Ann. & Mag. N. Hist. Ser. 8. Vol. x.* 19

The principal genera usually regarded as Blennioid and now excluded from the group are *Pataecus*, *Acanthoclinus*, and *Gadopsis*.

*Pataecus* proves to be a Scorpaenoid related to *Gnathanacanthus* (cf. Gill, Proc. U.S. Nat. Mus. xiv. 1891, p. 701).

*Acanthoclinus* is related to *Plesiops*, differing especially in the absence of a subocular shelf, the increased number of vertebræ and of dorsal and anal spines, the more advanced pelvic fins with fewer rays, the smaller scales, and the additional lateral lines. The pelvic fin of *Plesiops* has a spine and four soft rays, the first long, thick, and bifid, the third and fourth small and slender; that of *Acanthoclinus* differs only in the absence of the two inner rays. *Acanthoclinus indicus*, Day, 1888, has large scales and only one lateral line; I propose for it the new generic name *Acanthoplesiops*.

*Gadopsis* has the pelvic fins jugular, reduced to a small spine and a bifid ray; the crowding of the posterior dorsal and anal rays, the intervention of the prootic between parasphenoid and alisphenoid, the three anal spines, &c. are against Blennioid relationships; this genus is a Percoid of isolated position.

#### Division 1. BLENNIIFORMES.

Each basal bone of the dorsal and anal fins attached to its own neural or hæmal spine. Suborbital ring stout, rigid; præorbital expanded inwards and firmly united with the lateral ethmoid; postorbital similarly expanded and solidly united to a lateral expansion of the frontal.

#### Family 1. Blenniidæ.

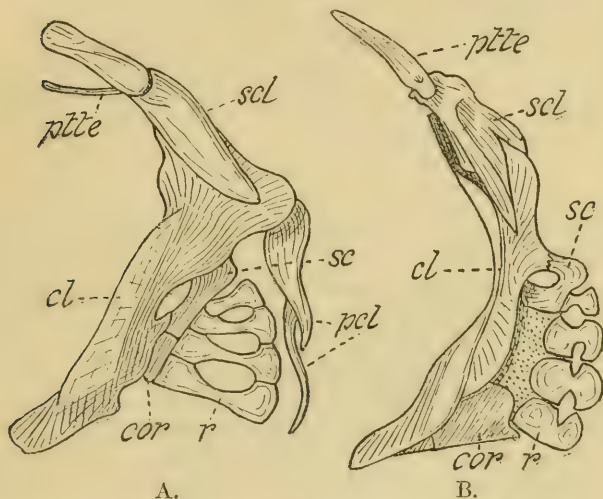
Body naked. Spinous and soft-rayed portions of the dorsal fin subequal; 1 or 2 anal spines; caudal free, with about 13 principal rays; pelvics jugular, each of a small spine and 2 to 4 simple rays. Mouth not protractile; maxillary almost or quite excluded from the gape; jaws with a single series of slender close-set teeth, resembling the teeth of a comb, within which curved canines may be developed; palate usually toothless. Palatines separated by the vomer; pterygoid connecting palatine with quadrate. Parietals separated by the supraoccipital; exoccipital condyles wide apart; skull more or less contracted and compressed immediately behind the postorbital expansions of the frontals; sphenotic remote from the orbit. Post-temporal forked; two post-cleithra on each side; hypercoracoid and hypocoracoid

in contact, narrow, especially the latter, which is not developed below the base of the pectoral fin; radials elongate, 4 in number (fig. 1, A); pelvic bones short, firmly attached at the cleithral symphysis.

Principal genera: *Ophioblennius*, *Blennius*, *Salaria*, *Andamia*, *Chasmodes*, *Petroscirtes*, *Xiphasia*, from tropical and temperate seas.

In *Ophioblennius webbi* I find that the comb-like outer series of teeth is developed, although very small; this genus differs from other Blenniidae in the presence of symphyseal canines and of more than one lateral canine in the lower jaw. *Xiphasia* has the head, mouth, teeth, gill-openings, &c. of *Petroscirtes*, but differs from that genus in the very long tail and greatly increased number of fin-rays and vertebræ.

Fig. 1.



Pectoral arch of A. *Blennius bufo* and B. *Anarrhichas lupus*.

*ptte*, post-temporal; *scl*, supra-cleithrum; *cl*, cleithrum; *pcl*, post-cleithrum; *sc*, hypercoracoid; *cor*, hypocoracoid; *r*, radials.

## Family 2. *Anarrhichadidae* \*.

Body naked or with vestigial scales. Dorsal fin formed

\* Since this paper was written Dr. Gill has issued a memoir entitled "Notes on the Structure and Habits of the Wolfishes" (Proc. U.S. Nat. Mus. xxxix. 1911, pp. 157-187, pls. xvii.-xxviii.)—a valuable account of the fishes of this family.

entirely of flexible spines; caudal with about 13 principal rays; pelvics absent. Mouth not protractile; præmaxillaries fixed; maxillary entering the gape; jaws with conical canines anteriorly; strong molar teeth at the sides of the lower jaw and on the vomer and palatines; pterygoid connecting palatine with quadrate. Parietals separated by the supraoccipital; exoccipital condyles separate. Post-temporal simple, the lower fork represented by a ligament; no post-cleithra; hypercoracoid and hypocoracoid well developed, widely separated by cartilage; radials plate-like, not elongate (fig. 1, B).

*Anarrhichas* and *Anarrhichthys*, with a few species, are large fishes of the northern seas. In *Anarrhichas lupus* I count 77 vertebræ (26 + 51), and in the eel-shaped *Anarrhichthys*, with about 250 dorsal rays, there are probably about 250 vertebræ.

L. A. Adams (Bull. Univ. Kansas, 1908, pp. 331-355, pls. xxv.-xxxvi.) has given a detailed description of the skull of *Anarrhichthys*. *Anarrhichas* is very similar, and both show considerable resemblance to *Blennius* in cranial structure.

### Family 3. Congrogadidæ.

Body covered with small scales. Caudal of 9 or 10 rays, joined to the dorsal and anal; all the fin-rays articulated, or the first of the dorsal spinous; pelvics, if present, jugular, 1- or 2-rayed, appearing as a pair of filaments. Mouth protractile, with strongly developed lips; maxillary excluded from the gape; jaws with a single series of conical or somewhat compressed teeth; palate usually toothless. Palatines separated by the vomer; pterygoid unconnected with palatine or mesopterygoid, curved backwards above the quadrate (fig. 2, B). Parietals separated by the supraoccipital; exoccipital condyles almost contiguous. Post-temporal forked; hypercoracoid and hypocoracoid in contact, rather narrow; radials small, hourglass-shaped.

### Synopsis of the Genera.

- I. No dorsal spine; gill-membranes united, free from the isthmus; 6 branchiostegals; lateral line incomplete; no pelvic fins.

1. *Congrogadus*.

- II. First dorsal ray a short spine; gill-membranes joined to the isthmus; 4 branchiostegals.

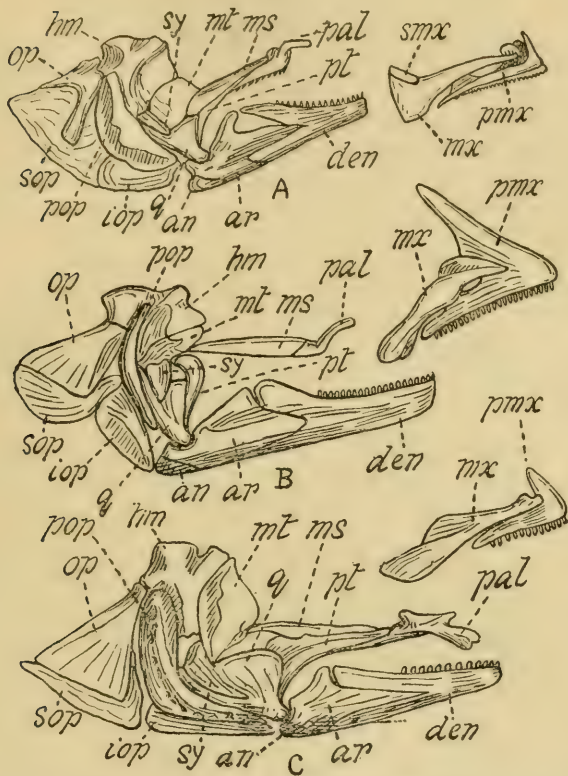
Lateral line incomplete; pelvic fins present .....	2. <i>Blennodesmus</i> .
Lateral line complete; no pelvic fins .....	3. <i>Haliophis</i> .
Three lateral lines; pelvic fins present .....	4. <i>Halidesmus</i> .



*Congrogadus* (including *Hierichthys*) comprises three species from Japan, the East Indies, and Northern Australia.

*Blennodesmus scapularis*, Günth., from Rockhampton,

Fig. 2.



Jaws, suspensorium, and opercular bones of A. *Brotula jayakari*,  
B. *Congrogadus subducens*, and C. *Zoarces viviparus*.

*pmx*, premaxillary; *mx*, maxillary; *smx*, supra-maxillary; *den*, dentary; *ar*, articular; *an*, angular; *pal*, palatine; *pt*, pterygoid; *ms*, mesopterygoid; *mt*, metapterygoid; *hm*, hyomandibular; *sy*, symplectic; *q*, quadrate; *pop*, preoperculum; *op*, operculum; *sop*, suboperculum; *io*, interoperculum.

*Haliophis maculatus*, Rüpp., from the Red Sea, and *Haliodesmus scapularis*, Günth., from Port Elizabeth, resemble each other in the presence of a spot or ocellus above the

pectoral fin, as is indicated by the specific names ; all are small littoral forms.

I have examined the skeleton of *Congrogadus subducens*, and I have ascertained that *Halidesmus* agrees with it in the structure of the pterygoid.

#### Family 4. *Notograptidæ*.

Body covered with small scales. Vertical fins confluent ; each dorsal and anal ray, except the last two, which are branched, a slender pointed spine to which a distal filament is attached posteriorly ; caudal of 11 branched rays ; pelvics small, jugular, 1-rayed, appearing as a pair of simple filaments. Mouth not protractile ; a short mental barbel ; maxillary excluded from the gape, reduced to a slender rod ; broad bands of small pointed teeth in the jaws and on the palatines, which nearly meet in the middle line below the toothless vomer ; pterygoid connecting palatine with quadrate. Parietals meeting above the supraoccipital ; exoccipital condyles wide apart. Post-temporal forked ; hypercoracoid and hypocoracoid well developed, in contact ; radials hourglass-shaped.

This family includes but a single species, *Notograptus guttatus*, Günth., represented in the British Museum by three examples from Cape York and Bowen.

#### Division 2. CLINIFORMES.

Each basal bone of the dorsal and anal fins attached to its own neural or hæmal spine. Suborbital ring laminar, movable. Exoccipital condyles wide apart.

#### Family 1. *Clinidæ*.

Body usually scaly. Dorsal with spinous portion more extended than the soft, or with all the rays spinous ; 1 or 2 anal spines ; caudal free, with about 13 principal rays ; pectorals broad-based ; pelvics jugular, of a spine and 3 or 4 simple articulated rays, 2 or 3 of which are usually thickened, closely articulated and free distally. Gill-membranes united, free from isthmus. Mouth protractile ; conical or villiform teeth in jaws and often on vomer and palatines. Suborbitals not stout ; præorbital a lamina with a small pit on its upper edge articulating with a small facet on the lateral ethmoid ; postorbital a lamina adherent by its upper edge to the skull. Postorbital part of skull of nearly equal width throughout ;

parietals separated by supraoccipital; a basisphenoid; parasphenoid meeting alisphenoids; exoccipital condyles wide apart. Post-temporal forked; 2 post-cleithra on each side; 4 flattened radials inserted on hypercoracoid and hypocoracoid, which are in contact and well-developed, the latter continued forward below the base of the pectoral. Pelvic bones erect laminae that meet above and enclose a chamber between them. Vertebrae 34 to 57 (10-22 + 24-35) or more; præcaudals with parapophyses from the sixth or seventh to the last.

The principal genera are: *Heterostichus*, *Clinus*, *Gobioclinus*, *Sticharium*, *Emnion*, *Neoclinus*, *Emblemaria*, *Cristiceps*, *Exerpes*, *Auchenopterus*, *Tripterygium*, *Lepidoblennius*, from tropical and temperate seas.

### Family 2. Dactyloscopidæ.

Body scaly; a single lateral line. Dorsal with the spinous portion less extended than the soft; anal long, preceded by 2 spines; caudal free, with 10 or 11 principal rays; pectorals broad-based, somewhat procurent below; pelvics jugular, each of a small spine and 3 simple articulated rays. Mouth protractile; jaws with bands of cardiform or villiform teeth; palate toothless. Operculum fringed; gill-membranes not united, free from the isthmus. Head-skeleton as in the Clinidæ, except that there is no basisphenoid; parasphenoid meeting frontals. Pectoral arch as in the Clinidæ, except that the hypercoracoid and hypocoracoid are separated and the two lower radials are inserted on the cleithrum (fig. 3, 1); pelvic bones formed exactly as in the Clinidæ.

Four genera: *Gillellus*, *Dactyloscopus*, *Dactylagnus*, and *Myxodagnus*, from the coasts of tropical America.

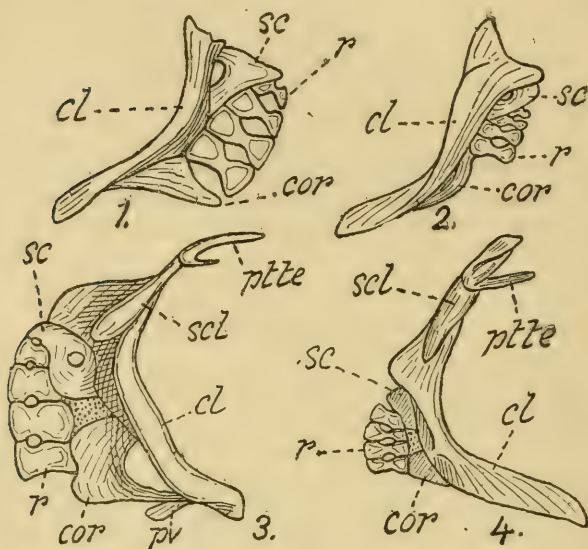
In *Dactyloscopus tridigitatus* I count 46 vertebrae (12 + 34); there are 10 pairs of ribs, the last 7 inserted on parapophyses.

### Family 3. Xiphidiontidæ.

Body covered with small scales; 3 or 4 lateral lines with numerous vertical branches. Vertical fins confluent; dorsal formed of spines only; anal long; caudal with 15 branched rays; pectorals small; pelvics absent. Mouth small, scarcely protractile; jaws with conical or villiform teeth and with anterior canines; palate toothless. Gill-membranes united, free from the isthmus. Head-skeleton as in the Clinidæ, except that there is no basisphenoid; parasphenoid meeting

frontals. Pectoral arch much as in the *Dactyloscopidæ*, except that the coracoids and radials are smaller (fig. 3, 2).

Fig. 3.



Bones at base of pectoral fin of 1. *Dactyloscopus tridigitatus* and 2. *Xiphidion chirus*. Pectoral arch of 3. *Zoarces viviparus* and 4. *Brotula jayakari*.

Lettering as in fig. 1; *pv*, pelvis.

*Xiphidion* comprises a few species, eel-shaped shore-fishes of the North Pacific.

In *Xiphidion chirus* I count 76 vertebræ (24 + 52); parapophyses are developed on the præcaudals from the fourth.

#### Family 4. *Stichæidæ*.

Body usually scaly. Caudal either free or united with the dorsal and anal, usually with 15 principal rays. Pelvic fins, when present, jugular, with the soft rays normally branched. Parietals separated by supraoccipital; no basi-sphenoid; parasphenoid meeting frontals. Præorbital with an inner shelf attached anteriorly to the posterior face of lateral ethmoid; suborbitals well ossified; exoccipital condyles above the basioccipital, with articulating surfaces looking downwards and backwards; centrum of first vertebra



concave anteriorly; normal parapophyses on most of the præcaudal vertebrae. Post-temporal forked; hypercoracoid and hypocoracoid well-developed, in contact or scarcely separated; radials sometimes hourglass-shaped, but usually rather short and squarish, inserted on the coracoids. Pelvic bones slender, elongate, not expanded vertically.

The numerous genera may be arranged thus:—

I. Dorsal with a posterior soft-rayed portion.

*Dictyosoma, Eulophias, Neozoarces, Cebedichthys, &c.*

II. Dorsal fin of spines only.

*Chirolophus, Stathmonotus, Anoplarchus, Opisthocentrus, Plagiogrammus, Stichæus, Dinogunnellus, Cryptacanthodes, &c.*

All are inhabitants of Arctic or northern seas.

### Family 5. Pholididæ.

Closely related to the Stichæidæ, differing in that the præcaudal parapophyses are united to form closed hæmal arches. The body is elongate, compressed, covered with very small scales; there is no lateral line. The vertical fins are confluent; the dorsal is long and low, of 75 to 100 short spines; the anal, preceded by 1 or 2 spines, is about half as long as the dorsal; the pectorals are rather small, placed low, and the pelvics, when present, are formed each of a spine and one small soft ray. The mouth is rather small, oblique, with conical or villiform teeth in the jaws and sometimes on the palate; the gill-membranes are united, free from the isthmus.

*Pholis, Apodichthys, &c.*, small shore-fishes of Arctic and northern seas.

### Family 6. Lumpenidæ.

Differs from the Stichæidæ especially in that the præorbital is represented by the inner shelf only, the suborbitals are not ossified, and the anterior surface of the first vertebra is convex, fitting into the single concavity formed by the basi-occipital and by the laterally placed exoccipital condyles.

The body is very elongate, little compressed, covered with small scales; the lateral line is indistinct or absent. The caudal, of 13 principal rays, is free; the dorsal is long, of 55 to 75 slender spines; the anal, preceded by 2 or 3 spines, is more than half as long as the dorsal; the pectorals are well developed and each pelvic is formed of a spine and 3 or 4 branched rays. The head is longer, the eyes larger, and the mouth less oblique than in the Xiphidiontidæ or Pholididæ;

small conical teeth are present in the jaws and sometimes on the palate; the gill-openings are rather wide, the gill-membranes being joined to the isthmus below the præoperculum.

In *Lumpenus lampetiformis* there are 81 vertebræ (28 + 53); the skull has the interorbital region narrower and the postorbital part shorter and flatter above than in *Chirolophus*, *Dictyosoma*, *Pholis*, &c.

It is doubtful whether more than one genus is really definable: *Lumpenus*, Reinh., with a few species from Arctic and northern seas.

#### Family 7. *Microdesmidæ*.

Body elongate, covered with small scales; no lateral line. Vertical fins confluent; dorsal long, anteriorly of slender spines, posteriorly of soft rays; anal without spines; caudal of 15 principal rays; pelvics subthoracic, of a small spine and 1 or 2 soft rays. Mouth small, not protractile, terminal, oblique, with the lower jaw prominent; teeth in the jaws only; eyes small; suborbitals apparently not ossified; gill-openings small oblique slits in front of the lower part of the pectorals.

Three species, from the Pacific coast of Tropical America, have been referred to two genera, *Microdesmus* and *Cerdale*. In *Microdesmus dipus*, Günth., I find that each pelvic fin consists of a small spine and 2 soft rays, the outer simple, the inner bifid distally; in some features this species recalls the Stichæid *Cebedichthys*.

#### Family 8. *Ptilichthyidæ*.

*Ptilichthys goodei*, Bean, from the North Pacific, has the naked body extremely elongate, tapering posteriorly, without caudal fin; the anterior part of the dorsal fin is formed of short isolated spines, and the soft dorsal and anal are many-rayed; there are no pelvic fins. There is a broad mental barbel; the mouth is terminal, non-protractile; the teeth form a single series in the jaws; the gill-membranes are united but free from the isthmus, and the gill-openings are restricted from above. According to Gilbert\* the post-temporal is not forked, but is a very slender bony rod; the coracoids are well-developed and are not separated by cartilage; the radials are large, hourglass-shaped, one on the

\* Gilbert, in Jord. & Everm. Fish. N. Amer. iii. pp. 2451-2452 (1898).

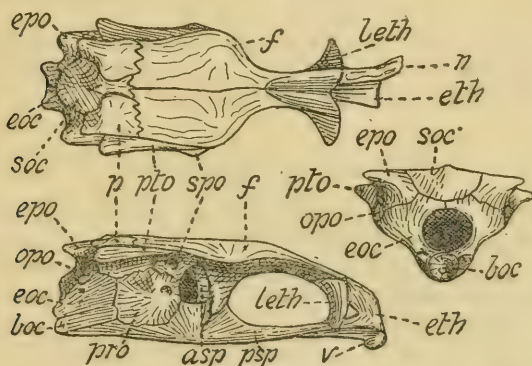
hypercoracoid and three on the hypocoracoid. If, as is probable, the fin-rays correspond to the myotomes, the vertebræ number about 235.

### Family 9. Zoarcidæ.

There are no spinous fin-rays, except sometimes a few posterior rays of the dorsal, the ventral fins are confluent and the pelvic fins, when present, are small, jugular. The mouth is non-protractile, the suborbitals are delicate, attached as in the Clinidæ, and the gill-membranes are joined to the isthmus. The width of the gill-openings is extraordinarily variable; in *Melanostigma* they are small foramina, in *Lycodapus* and *Bothrocara* they extend forward to below the eye; other genera are intermediate.

I have examined the skeleton in *Zoarces* and *Lycodes*. The skull is flattish above, with the frontals narrowed between and expanded behind the orbits; the parietals are

Fig. 4.



Skull of *Zoarces viviparus* from above, from the side, and from behind.

*n*, nasal; *eth*, mesethmoid; *leth*, lateral ethmoid; *v*, vomer; *psp*, parasphenoid; *asp*, alisphenoid; *f*, frontal; *p*, parietal; *soc*, supraoccipital; *eoc*, exoccipital; *boc*, basioccipital; *pro*, prootic; *spo*, sphenotic; *pto*, pterotic; *epo*, epiotic; *oyo*, opisthotic.

separated by the supraoccipital, which has a feeble crest or none; the exoccipital condyles are widely separated and the wing of the parasphenoid meets a descending process of the frontal; the opisthotic is small, the pterotic elongate, and the sphenotic not very prominent. These features are shown in the figures of the skull of *Zoarces viviparus* (fig. 4), from

which *Lycodes frigidus* differs chiefly in the greater length of the narrow orbital portion of the frontals. The jaws, suspensorium, and opercles (fig. 2, C) are much as in the Stichæidæ, as is the pectoral arch except for the separation of the coracoids by cartilage (fig. 3, 3). The vertebræ are numerous, 112 (24+88) in *Zoarces* and 102 (22+80) in *Lycodes*; strong transverse processes are present on the præcaudals from the first to the last; the ribs are slender.

A variety of forms, chiefly from Arctic and northern seas, but with Antarctic representatives also.

The principal genera are: *Zoarces*, *Lycodes*, *Embryæ*, *Lycodopsis*, *Aprodon*, *Lycenchelys*, *Lycodonus*, *Lyconema*, *Melanostigma*, *Gymnelis*, *Bothrocara*, *Lycodapus*, *Phucocætes*, *Ilucetes*, *Platea*, *Maynea*.

*Lycodapus*, Gilbert, includes small deep-sea fishes of the North Pacific, and has been made the type of a distinct family and placed near the Fierasferidæ. But the head and mouth recall those of *Lycodopsis* or *Bothrocara*, the gill-membranes join the isthmus between the rami of the lower jaw (at least in *L. fierasfer*), and the dorsal and anal rays correspond in number to the myotomes.

Two other aberrant genera, *Scytalina* and *Rhodichthys*, are closely related to the Zoarcidæ, but may for the present be regarded as the types of separate families.

#### Family 10. Scytalinidæ.

*Scytalina cerdale* is a small eel-like fish known only from specimens obtained on the shores of Waadda Island, in the Straits of Juan de Fuca, where it lives in the wet shingle. The very small eyes placed far forward and the tumid cheeks give it a physiognomy unlike that of the Zoarcidæ; the gill-membranes are united, but not joined to the isthmus; the pectoral fins are small and the pelvics absent. The skull is much more depressed than that of *Zoarces* or *Lycodes*, the frontals gradually increase in breadth backwards, and the union of the parasphenoid and frontals is very elongate, almost as in the Symbranchidæ. The parietals, occipital and otic bones are much as in *Zoarces*; the suspensorium, opercles, and pectoral arch are also as in *Zoarces*, except that the very small coracoids are in contact; the vertebræ number 69 (22+47); strong transverse processes are present on the præcaudals from the third to the last.



Family 11. *Rhodichthyidæ*.

*Rhodichthys regina* is known to me only from Collett's description and figures\* of the type, 297 mm. in total length, from the depths of the North Atlantic; it is a very remarkable fish, naked, translucent, and bright red in colour; it agrees with the *Zoarcidæ* in the restricted gill-openings, the jugular position of the pelvic fins, and the correspondence between the fin-rays and the myotomes. The vent is placed at the throat and each pelvic fin is a long bifid filament, characters which indicate that this fish should probably rank as the type of a separate family.

## Division 3. OPHIDIIFORMES.

Dorsal and anal basalia outnumbering the corresponding neural or hæmal spines. Suborbital ring, when ossified, as in the Cliniformes. Operculum V-shaped. No spinous fin-rays. Exoccipital condyles meeting above the basioccipital; anterior face of first centrum convex, fitting the slight concavity of the basioccipital.

The three families have also the following characters in common:—

Pelvic fins, when present, jugular or mental, close together, each of 1 or 2 filamentous rays. Teeth cardiform or villiform, in bands in the jaws and usually on the vomer and palatines; præmaxillaries with short ascending processes; maxillaries well developed, expanded behind. Palatine with a maxillary process; pterygoid normally connected with palatine and quadrate; hyomandibular very broad; operculum V-shaped, the upper fork usually forming a sharp spine; suboperculum large; 6 to 8 branchiostegals. Cranium elongate, with the postorbital portion longer than the orbito-rostral and the parasphenoid united with the frontals in front of the pro-otics and alisphenoids; ethmoid keeled. Post-temporal more or less distinctly forked; coracoids weakly ossified; pectoral radials 4, moderate. First two vertebræ short; third with a sessile rib, which is expanded to support the air-bladder.

Family 1. *Brotulidæ*.

The pelvic fins, when present, are jugular and the vent is remote from the head. As a rule the long dorsal and anal

\* Norwegian N. Atlantic Exped. Fish. p. 153, pl. v. (1880).

fins are confluent with the reduced caudal, but the latter may be well-developed and free (*Dinematichthys*) or may be absent. The gill-openings are wide, with the gill-membranes separate and free from the isthmus (except in *Dermatopsis*). The mouth is usually protractile.

This family includes the blind cave-fishes of Cuba (*Stygicola* and *Lucifuga*) as well as a number of marine forms, some of those inhabiting the depths of the sea being extraordinarily aberrant (*Tauredophidium*, *Aphyonus*, *Typhlonus*, *Acanthonus*, &c.). Many have been described by Günther ('Challenger' Deep-sea Fishes), and Goode and Bean ('Oceanic Ichthyology') give a useful synopsis of the genera.

I have examined the skeleton of *Brotula jayakari*, and I have already figured the skull (Ann. & Mag. Nat. Hist. (7) xi. 1903, p. 461). The parietals are separated by the supra-occipital, the latter forms with the exoccipitals a strong median crest which does not project above the level of the upper surface of the skull, the opisthotic is not enlarged, the basioccipital and pro-otic form a rather prominent auditory bulla.

The structure of the jaws, the hyo-palatine and opercular bones (fig. 2, A), and the pectoral arch (fig. 3, 4) is shown by the figures; the lower fork of the post-temporal is directly attached to the opisthotic, and the hypercoracoid and hypocoracoid are separated by cartilage.

In *Brotula jayakari* there are 55 vertebræ (15 + 40); the first two vertebræ are short and bear sessile epipleurals; the third, fourth, and fifth bear sessile ribs, the first two pairs being expanded; from the sixth to the fifteenth the ribs are borne by strong transverse parapophyses.

Emery has figured the suspensorium of *Pteridium atrum*\*, but I find that his figure is incorrect and that the pterygoid, mesopterygoid, and metapterygoid are exactly as in *Brotula*; he has overlooked the suture between pterygoid and mesopterygoid, and has mistaken the anterior part of the metapterygoid for the latter bone.

## Family 2. Ophidiidæ.

Differ from the preceding externally in the anterior position of the pelvic fins, inserted between the rami of the lower jaw; behind them the gill-membranes are attached to the isthmus. I have examined the skeleton of *Genypterus blacodes*, which differs from that of *Brotula* especially in the

\* Fauna u. Flora d. Golf. v. Neapel, ii. (1880).

ankylosis of the pterygoid and mesopterygoid, and the prolongation forwards of the cleithra within the isthmus as a pair of slender processes, with the pelvic bones attached at their extremities. The lower fork of the post-temporal is shortened and attached to the opisthotic by a ligament, and the coracoids are in contact. There are 72 vertebræ (20 + 52): the first five are as in *Brotula*, except that only the first rib is expanded; the anterior six pairs of parapophyses (on vertebræ 6-11) are strong and broad, much as in *Merluccius*, the rest are normal.

Principal genera: *Ophidium*, *Otophidium*, *Lepophidium*, *Genypterus*, from tropical and temperate seas, some inhabiting deep water.

*Dereiodichthys*, Gilbert, from the North Pacific, has the mouth non-protractile, the body naked, and the gill-openings more restricted than the others; it may not pertain to this family and may prove to be related to the Zoarcidæ.

### Family 3. Fierasferidæ.

Differ externally from the Brotulidæ in that the anal fin extends further forward and the vent is placed at the throat, caudal and pelvic fins are absent\*, and the mouth is non-protractile. The cranium shows many striking resemblances to that of *Brotula*, but differs in that the parietals meet above the supraoccipital, the occipital crest is weak, and the exoccipitals do not take part in its formation, and the enlarged opisthotic reaches the basicoccipital, sharing with that bone and the pro-otic in the formation of the auditory bulla†. The lower fork of the post-temporal is reduced to a little knob; otherwise the pectoral arch is as in *Genypterus*. In *Fierasfer acus* (fide Emery) the vertebræ number 125 to 144, of which 17 or 18 are præcaudal; in *F. dentatus* there are 26 præcaudal vertebræ; the first rib is more strongly expanded in the former species than in the latter.

Seeing that the Fierasferidæ had always been placed near the Optidiidæ, and that Emery's anatomical researches confirmed this view as to their systematic position, it is not

\* I at one time thought that a reduced homocercal fin was present in some Fierasferidæ, as in the Brotulidæ; but on looking into the matter I find that whenever a caudal fin appears to be present it is due to regeneration after the end of the tail has been broken off.

† These features were first described by Emery (Faun. u. Flora d. Golf. v, Neap. ii. 1880), and I am able to confirm the accuracy of his account of the head-skeleton, after preparing and examining that of *F. acus*.

easy to understand Boulenger's transference of the family to the Heteromi, with which they have practically nothing in common.

There are two genera, *Fierasfer* and *Jordanicus*, widely distributed in tropical and temperate seas.

### XXXVII.—*Two new West-African Mammals.*

By OLDFIELD THOMAS.

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#### *Mungos phœnicurus*, sp. n.

A small species with the terminal pencil of the tail rich reddish.

General appearance that of the members of the *gracilis* group of the genus, apart from the red tail-tip. Colour most nearly approaching that of a pale Lake Zuai specimen of *M. gracilis*, far paler than the West-African *M. melanurus*. General colour of back approaching "clay-colour," paler and more buffy on the shoulders, more rufous on the posterior back. Head as usual greyer than back, but still with a buffy tone in it. Sides grizzled buffy. Under surface uniform buff, the throat more "cream-buff." Hands and feet dull buffy, rather darker than "cream-buff." Tail coarsely grizzled with black and buffy above, uniform ochraceous buff below; the full terminal pencil deep tawny rufous.

Dimensions of the type (measured in the flesh):—

Head and body 330 mm.; tail 289; hind foot 61; ear 28.

Skull: condylo-basal length 68·3; zygomatic breadth 33·5; palatal length 35·4; greatest diameter of  $p^4$  7·7.

*Hab.* Panyam, Bauchi Province, N. Nigeria. Alt. 4000'.

*Type.* Old male. B.M. no. 12. 7. 9. 2. Collected 12th February, 1912, and presented by the late Rev. G. T. Fox.

The only other known mungoose with a red tail-tip is *M. sanguineus*, Rüppell, of Kordofan, which is considerably smaller (hind foot 50–54 mm.), is lighter coloured throughout, and has the under surface white instead of buffy.

In Mr. Wroughton's monograph of this group he assigned to *M. sanguineus* an example from Suakin with the tail-tip "half chocolate-brown and half black," but the conspicuous and evidently natural red tail-tip of the N. Nigerian species leads me to think that *sanguineus* has also a really red tail-tip and that the Suakin specimen is merely one of the ordinary



*gracilis* type with a more or less bleached tail-tip. Examples of the true Kordofan *sanguineus* would be valuable accessions to the British Museum collection.

The type of the present handsome and distinct species was obtained by Mr. Fox shortly before his death, and was forwarded to the Museum by his brother Mr. J. C. Fox.

*Kerivoula phalæna*, sp. n.

A small pale brown species with subequal incisors.

Size as in the smallest members of the genus. Fur long, soft, and fine; hairs of back about 7 mm. in length. General colour above uniform pale reddish brown—like “Mars-brown” of Ridgway, but much paler; the hairs of this colour all through, except that on the posterior back they have inconspicuously darker bases. Extreme tips of some of the rump-hairs silvery buff. Under surface similar but rather paler, and with more blackish at the bases of the hairs. Membranes and wings almost naked, the base and edge of the inter-femoral with thinly scattered hairs, not forming a fringe, the upper surface of the legs thinly hairy, the feet well haired.

Ears with inner margin strongly convex, a distinct concavity below the tip. Tragus slender, straight, a well-marked projection at its outer base, succeeded above by an emargination, above which there is again a projecting point, forming the broadest part of the tragus; in front of the middle of the base there is a wart clothed with long hairs, forming a loose tuft; a particularly prominent tragoid projection present facing the tragus on the inner side of the outer base of the ear.

Skull very light and delicate, with narrow brain-case. Upper incisors subequal in length, the outer rather shorter, and practically unicuspid, a small secondary cusp at the extreme posterior base of the inner one and at the internal base of the outer. First and second lower incisors tricuspid, third with a single large rounded cusp with minute anterior and posterior secondary cusps.

Dimensions of the type (the starred measurements taken in the flesh) :—

Forearm 29·5 mm. (28 mm. in the male).

Head and body \*33; tail \*40; ear \*13; third finger, metacarpus 29·5, first phalanx 12·5; lower leg and foot 18·8.

Skull: greatest length 12·1; basi-sinual length 9·1; zygomatic breadth 7·1; breadth of brain-case 6·1; front of upper canine to back of  $m^3$  5·1.

*Hab.* Bibianaba, inland of Denkwa, Gold Coast. Alt. 720'.

*Ann. & Mag. N. Hist. Ser. 8. Vol. x.*

20

*Type.* Adult female. B.M. no. 12. 6. 20. 3. Original number 224. Collected 24th April, 1912, and presented by Dr. H. G. F. Spurrell. Male and female skins, female and young in spirit examined.

This delicate little *Kerivoula* belongs to Dobson's second group of the genus, and would seem to be allied to *K. lanosa* and *smithii*, but is markedly smaller than either.

Perhaps its nearest relative is the Kamerun *K. muscilla*, Thos., which is, however, distinguishable by its more inflated brain-case and its interfemoral fringe.

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### XXXVIII.—*Self-evisceration in the Asteroidea.*

By NATHANIEL COLGAN, M.R.I.A.

IN the considerable body of extant literature which deals with the subject of autotomy, or self-mutilation, I can find no instance on record of self-evisceration in the Asteroid section of the Echinodermata, although the existence of that curious propensity or infirmity in the Holothuroid division is well known to every student of the phylum. The following notes of observations made three years ago on some living specimens of the common *Cribella oculata* of Pennant—*Henricia sanguinolenta*, O. F. Müller—are accordingly published here in the belief that they may contain something new and may stimulate to further research.

On the 17th April, 1909, I took at low tide from the shore near Bullock, Dublin Bay, two living specimens of this species. The larger of the two was quite regular in form, with a spread of arms measuring 4 inches, the smaller, with a spread of  $3\frac{1}{2}$  inches, had a sixth supernumerary arm from the upper surface of which protruded a monstrous wart placed midway between the disk and the tip of the arm. In the hope that these specimens might deposit ova and so enable me to study the early stages in the development of the species, they were placed in sea-water, each in a separate dish, just deep enough to permit of the animals being fully immersed.

Four days later, on the 21st April, on examining the smaller specimen with the abnormal sixth ray, I was astonished to find that it had completely eviscerated itself. The paired dendroid pyloric cæca, closely resembling those of *Asterias rubens* as figured by Müller and Troschel, hung in festoons from the tip of each of the five normal rays,

while a sixth mass of cæca issued from the wart-like protuberance halfway down the upper surface of the supernumerary sixth ray. Each of the five normal rays was ruptured for a length of 5 mm. on the upper surface close to the tip, and from these small slits protruded the whole cæcal contents of the ray still paired by their basal connection. The animal thus eviscerated was in a lively condition. It moved across the dish with its tube feet in active motion and the dermal branchiæ exerted, and when turned over on its back was able to quickly resume its normal position. The rays had become flattened and in places even concave by the withdrawal of the cæca. This individual lived for three days after the rejection of its cæca, and on the 22nd April, the day after this rejection, a mass of orange gonads was seen to issue from the ruptured tip of one of the arms. Though changed from time to time, the water in which this specimen was kept became rather stale at intervals, as it did with the other specimens dealt with in these notes.

The actual process of self-eviscération, which I had no opportunity of observing in this six-rayed individual, I was enabled to watch closely in the larger and normally five-rayed specimen taken on the same day, the 17th April. At 11 A.M. on the 23rd April the first sign of extrusion was noticed. A small lump of tawny cæca made its appearance on the upper surface and near the tip of one of the arms. Three-quarters of an hour later this extrusion was completely withdrawn and no trace of rupture could be made out on examining the tip of the arm with a hand lens. No further extrusion took place that day, but at 8 A.M. on the following day, 24th April, a mass of cæca as large as a pea was observed at the extremity of one ray and a much smaller mass at the tip of a second and adjacent ray. Half an hour later the smaller mass was found to have doubled in size and at 10 A.M. a fairly large extrusion appeared at the end of a third ray, adjacent to those already ruptured. Nearly two hours later, at 11.45 A.M., measurements were taken of the cæca extruded from the three contiguous rays, when the lengths were found to be 4, 8, and 11 millimetres respectively. About this time swellings and pale bands and blotches were seen to travel very slowly along the ruptured arms and to come and go on different parts of the disk, suggestive of the slowly propagated swellings which precede self-eviscération in certain Holothurians.

Further measurements of the extruded cæca made at 12.45 P.M. the same day gave lengths of 4, 10, and 16 millimetres, and about the same time orange-coloured gonads

were seen to issue in the normal way from the oviduct in the angle between two adjacent arms. At 1 P.M. the pale blotch on one of the arms was seen to accompany the swelling, which slowly travelled along the arm towards the ruptured extremity, and a further extrusion occurred as soon as the swelling and its accompanying pale blotch had reached the point of rupture. About the same time the tip of the fourth ray became ruptured and a portion of the cæca was extruded at the moment when a slowly travelling swelling had reached the tip. At four minutes to 7 P.M. on the same day a prominent swelling was seen to have travelled along the fifth ray almost to the tip, and watching this narrowly the beginning of a protrusion of the cæca, which ultimately reached to a length of 4 mm., was seen to take place at the moment when the swelling reached the extremity of the arm. While the extrusion was being slowly effected—it occupied fully four minutes—the unattached sucker feet near the tip of the ray were seen to be in vigorous spasmodic action, and the swelling proceeded to travel backwards along the ray towards the disk. The propagation along the rays of these swellings or waves of inflation was very slowly effected, the average of several observations giving a rate of 6 mm., or, say, a quarter of an inch per minute.

By 8 P.M. on the 24th April one pair of cæca was found to be fully extruded from an arm of this second specimen of *Cribella*. It was detached and placed in spirit and the following day the animal was treated with chloral and then preserved in spirit so as to show the unequal extrusion of the cæca from the tips of the other arms. In this case no gonads were observed to have been extruded from the ruptured arm-tips, as they probably would have been had the process of self-evisceration been suffered to proceed.

In October 1909, further observations were made on a third individual of this species, a regular 5-rayed specimen  $2\frac{1}{4}$  inches in diameter over all, which I had dredged in 10 fathoms off Bullock on the 25th of the month. On the morning of the 29th, four days after the capture, slight swellings and constrictions were noticed on some of the arms, and on the 31st two distinct knots or abrupt swellings appeared on one of them. For ten days these swellings continued to appear and to pass in very slowly propagated waves along the arms without any rupture being effected. Finally, at 8.30 A.M. on the 11th November, a minute rupture of the integument was observed on the upper surface of one of the arms near its tip, and from this breach a small



mass of the cæca was protruded. By the 14th November this mass had grown to a length of 6 mm., and two other arms showed protrusions of about 3 mm. in diameter; by the 17th the protrusions from all three arms had grown in size; and, finally, at 9 P.M. on the 18th, the two remaining arms were ruptured and showed small protrusions. This individual died the next day before self-evisceration had proceeded very far.

Is the peculiar form of self-evisceration here described purposeful or morbid? Is it in any way useful to the individual or to the species, or is it to be regarded as purely pathological? These are the questions suggested by the observations just recorded, and it must be confessed that it is not possible in the present state of our knowledge to do more than hint at an answer. The fact that the operation was seen to be effected by three distinct individuals of the same species would warrant at least the suspicion that it may be purposeful, and this suspicion gains a certain strength from the many observations already on record of the occurrence of an analogous operation in another section of the Echinodermata, the Holothuroid section. The manner, too, in which the effect is produced in *Cribella*, not by a catastrophic rupture, but by a long-continued series of muscular efforts, all tending towards the same end, may fairly be taken as further strengthening the inference of purpose, while the extrusion of the sexual products along with the viscera suggests, at all events, the nature of that purpose. It is, perhaps, hardly necessary to say that the word "purpose" here is not meant to imply any volitional action in the human sense. It merely denotes action helpful in reproduction and dissemination of the species; and the suggestion that autotomy, or self-mutilation, in the Asteroidea may be purposeful in this sense is not a novel one.

On the other hand, it may be urged in opposition to this hypothesis of purposeful self-evisceration that the unnatural conditions under which the living specimens were kept were such as to inevitably induce a morbid state of the organism. Exposed as they were to strong light for considerable periods while barely covered with water, which from time to time became more or less foul as compared with their native element, the animals must necessarily have grown sickly, so that the long-drawn-out muscular efforts which finally effected the extrusion of the viscera may have been merely symptoms of the approaching death of the organism. Obviously, further study of the life-history of *Cribella* and of

other species of the Asteroidea is necessary before one can venture with any degree of assurance to answer the questions raised by the observations recorded in these notes.

For assistance in consulting the scattered and by no means readily accessible literature of autotomy and self-evisceration, I am indebted to the kindness of Dr. Bather of the British Museum of Natural History, and of Mr. A. R. Nichols of the National Museum, Dublin.

XXXIX.—*New Species of Heterocera from Costa Rica*.—XVII. By W. SCHAUS, F.Z.S.

[Continued from p. 240.]

Subfam. GEOMETRINÆ.

PROUTOSCIA, gen. nov.

♂. Antennæ serrate and densely ciliate. Palpi short; second joint thickly scaled, third slender. Femora and tibiæ dilated, the hind tibiæ with large tufts of long hairs; ventral tufts at end of abdomen. Fore wings broad; outer margin rounded, slightly incurved above tornus; vein 2 from just beyond middle of cell; 3 and 4 apart; 6 from cell; 7 from end of areole; 8, 9, 10 stalked from end of areole; 11 from middle of areole. Hind wings broad, excised and lobed at anal angle; median approximated to inner margin; vein 2 apparently absent; 3 from near angle; 4 from angle; 5 from middle of discocellular, downbent towards angle; 6 from upper angle; 7 from cell; underneath with long tufts about anal angle, upturned hairy scales along vein 4, and down-turned scales along vein 6; an oblique ridge of hairy scales between veins 6 and 7. In the female the neuration is normal, and the tufts are absent; the anal angle is slightly produced.

*Proutoscia mirifica*, sp. n.

♂. Frons buff-white with black points. Vertex white shaded with lilacine grey behind. Collar and thorax mottled lilacine and whitish, with a few dark irrorations. Abdomen above lilacine grey; two dorsal and an interrupted lateral reddish-brown line. Wings: base and margins pale lilacine grey. Fore wings: disc of wing with a large semihyaline pale yellow space pointed towards base of cell, its hind edge

curved to near inner margin postmedially, its fore edge following subcostal, and interrupted on vein 6 by a projecting brown shade, its outer edge parallel with outer margin; this space is edged with reddish brown, and is followed from vein 2-7 by a narrower reddish-brown shade; an oblique brown line at base of costa; an elongated yellow spot edged with reddish below cell at base; a brown, sinuous antemedial line from cell to submedian below which it is deeply inbent; a subterminal fine dark purplish line from costa, curved before apex, and slightly inbent below vein 3. Hind wings: a subbasal yellow spot partly edged with reddish; a large semihyaline yellow space, angled towards base, upturned towards costa, constricted postmedially, and not expanding towards apex, edged with reddish brown; a reddish-brown postmedial line, and a yellow, reddish-edged spot below vein 7; the subterminal purple line sinuous to termen at vein 6; termen shaded with reddish brown from apex to vein 6; termen from 6-5 shaded with black. Wings below yellowish white, simply showing the semihyaline spaces.

Expanse 40 mm.

The female differs in having the terminal opaque space on fore wings broader; the semihyaline space on hind wings outbent towards middle of outer margin, and has five rounded projections; the subterminal line continues to inner margin, and there is no black shading near anal angle.

Expanse 42 mm.

*Hab.* Sixola.

*Oospila peralta*, sp. n.

♂. Palpi dark brown. Frons rubbed. Vertex green; a white line between antennæ. Body and wings deep green. Abdomen: three suffusing oval tufts on segments 2-4 dorsally, dark brown irrorated with white and silver; smaller brown dorsal tufts on following segments. Wings: faint traces of an outer and subterminal darker shade; terminal white spots extending on cilia which are otherwise fuscous brown tipped with white. Fore wings: costa finely yellow, with a few brown irrorations; a faint darker antemedial shade; a black discal point. Hind wings: a small white discal spot. Wings below greenish white; the costa of fore wing more broadly yellowish.

Expanse 26 mm.

*Hab.* Peralta.

Near *O. restricta*, Warr.

*Blechroma epaphras*, sp. n.

♂. Palpi black, edged below and above with white. Frons white mottled with brown; vertex and body above green; some brown mottlings on thorax; abdomen with four small white dorsal spots, and faint whitish segmental lines on following segments. Wings green with some scattered darker green spots; cilia whitish green, with small fuscous spots at veins. Fore wings: costa finely creamy white striated with fuscous grey; some antemedial smoky spots forming an inbent line; four fuscous spots about discocellular; an outer lunular smoky shade, slightly inset between veins 5 and 6. Hind wings; a fuscous spot at base; a fine antemedial line and smoky spot on inner margin; the outer smoky shade nearer termen from vein 4 to inner margin. Wings below greenish white; the costa of fore wings with dark striæ and spots; some small spots in cell, and larger spots at end of cell and beyond it; the outer line well marked on costa.

Expanse 28 mm.

*Hab.* Juan Vinas, Carillo.

*Tachyphyle oleaster*, sp. n.

♂. Frons green; vertex white. Thorax, abdomen, and wings dull green, the wings tinged with brown; minute black discal points; a greenish-white line from near apex of fore wing to middle of inner margin of hind wing. Fore wings: the costa brighter green; a faint whitish-green medial line; cilia rather long, silky green. Wings below whitish olive; the whitish lines indistinct; the apex of fore wing tipped with black; minute black discal points. The female has no black tip to apex of fore wing below.

Expanse, ♂ 21 mm., ♀ 30 mm.

*Hab.* La Florida, Sixola, Tuis, Guapiles.

*Tachyphyle hamata*, sp. n.

♂. Palpi white. Vertex white. Collar and thorax green; abdomen above paler green. Wings green. Fore wings: the apex falcate; the outer margin incurved; some brownish striæ in cell and below it, forming a faint antemedial line extending to submedian; a fine fuscous line on discocellular; outer space to termen shaded with brown, crossed by a broad dark purplish-brown shade, outwardly tinged with lilacine; this shade extends across middle of hind wings. Fore wings below dull dark green, the hind wings greenish white; a



broad dull purplish-green shade from apex of fore wing to middle of inner margin of hind wing.

Expanse 32 mm.

*Hab.* Tuis.

*Racheospila acutularia*, sp. n.

♂. Palpi brownish fringed with white below. Head and body green; a white line between antennæ; three dorsal white spots on abdomen, the first and third edged with dark red. Wings green; a terminal reddish-brown line, cut by fine buff lines on veins; cilia pale buff, darker-tipped, and with faint reddish shades at veins; minute black discal points; lines whitish, very fine; antemedial very indistinct; postmedial straight on fore wings, slightly angled on hind wings. Apex of fore wings acute, the costa white, shaded brown at base.

Expanse 25 mm.

*Hab.* Tuis.

Belongs to Sect. I.

*Racheospila agenoria*, sp. n.

♂. Palpi brown fringed with white below, the second joint long, the third minute. Frons dark green with lateral white points below; a white line between antennæ edged behind with brown. Thorax and abdomen above green; a small white spot edged with roseate brown dorsally at base; traces of segmental white lines and two points; in the female there are three dorsal spots of about the same size. Wings green; a terminal red line; cilia white tipped with greyish, and with narrow brownish shades at veins; an outer wavy lunular white line; black discal points. Fore wings: the costa finely white shaded with brown at base; an antemedial white line faintly wavy and outbent from costa. Hind wings: the antemedial white line slightly wavy, indistinct.

Expanse 22 mm.

*Hab.* Juan Vinas, Tuis.

Belongs to Sect. I. Allied to *R. livaria*, Gn., but distinguished by the green frons and more wavy lines.

*Racheospila dorsilinea*, sp. n.

♂. Palpi whitish tipped with reddish brown. Head reddish brown crossed by a white line between antennæ, and one near palpi. Body above green; a white dorsal line on thorax behind and on abdomen. Wings pale green finely

irrorated with darker green; a very fine terminal brownish-red line; cilia creamy white; minute black discal points. Fore wings: costa white shaded with brownish red at base; a fine white antemedial line, slightly outcurved; a fine white outer line, parallel with termen. Hind wings: a fine white outer line, slightly curved. Underneath greenish white, the costa of fore wing tinged with pale brown, and with dark red at base.

Expanse 25 mm.

*Hab.* Poas.

Belongs to Sect. I. *d*.

*Racheospila nympharia*, sp. n.

♂. Frons greyish brown edged with green in front. Vertex and body green; three dorsal white spots on abdomen faintly edged with reddish, the basal spot smallest. Wings green; a very fine terminal pale brownish line, sometimes absent; cilia buff-white, with faint darker shades at veins; minute black discal points; antemedial and postmedial lines fine, white, the antemedial outcurved, the postmedial straight on fore wings, faintly wavy on hind wings. The female has the frons darker brown, and the white line on vertex edged with reddish brown.

Expanse, ♂ 27 mm., ♀ 30 mm.

*Hab.* Juan Vinas, Sitio, Tuis.

Belongs to Sect. I. *d*.

*Racheospila strigaria*, sp. n.

♀. Frons brown. Vertex green; a white line between antennæ. Body green, with traces of paler green segmental lines on abdomen. Wings green crossed by whitish striæ; cilia green; costa of fore wings finely white. Wings below whitish green; some fuscous shading at base of costa, and similar faint irrorations above median on fore wings.

Expanse 29 mm.

*Hab.* Turrialba.

Belongs to Sect. I. *h*.

*Racheospila concinnaria*, sp. n.

♂. Palpi white shaded with light brown. Frons light brown crossed by a white line near palpi; vertex white. Body above green; a dorsal white line on abdomen. Wings pale green; antemedial and outer lunular white lines, the latter outbent between veins 3 and 4; minute black discal

points ; terminal minute white points ; cilia white tipped with pale greyish brown.

Expanse, ♂ 15 mm., ♀ 19 mm.

*Hab.* Sixola, Guapiles, Juan Vinas, Avangarez.

Belongs to Sect. II.

*Racheospila interlucens*, sp. n.

♂. Palpi reddish brown fringed with white. Frons reddish brown crossed by a white horizontal line ; vertex white, edged with reddish brown behind. Collar and thorax green. Abdomen above purple with short white segmental lines dorsally. Wings green ; an outer row of short purple streaks on veins ; a fine terminal roseate brown line ; cilia roseate white, with faint darker shades at veins. Fore wings : antemedial small purple spots on subcostal, median, and submedian ; costa white shaded with brown at base, and edged behind by a faint yellowish line ; a purple discal point. Hind wings : a large semi-oval purple spot on inner margin, edged with a broad yellowish shade on discal side. Underneath greenish white.

Expanse 27 mm.

*Hab.* Juan Vinas, Tuis.

*Racheospila porcius*, sp. n.

Palpi purplish fringed with white below. Frons purplish. Vertex green edged with white behind. Collar and patagia green. Thorax and abdomen above roseate brown, partly irrorated with black ; two white dorsal spots. Wings green ; discal spots rather large, lilacine brown. Fore wings : costa creamy white ; inner and outer lines paler green, edged on medial side with darker green, the former slightly outbent, the latter faintly outcurved and barely lunular, suffusing at vein 2 with roseate brown blotch on inner margin, which is downcurved to tornus, and upbent as a line on termen ; a similar large spot on outer margin from just above vein 4 to vein 8, its inner edge rounded ; both spots edged with purple-brown and then narrowly with orange-yellow ; termen green from below to above vein 4. Hind wings : termen from apex to near vein 4, and from 2 to inner margin broadly lilacine brown, edged as spots on fore wings, but connected by a fine terminal purple line ; a narrow purplish streak from anal blotch along inner margin, not reaching base.

Expanse 29 mm.

*Hab.* Juan Vinas.

Near *R. fallax*, Warr., but spots all larger.

*Leptolopha marginata*, sp. n.

♀. Palpi buff-white. Frons reddish brown; a white line between antennæ. Body above green; abdomen with yellowish-white dorsal line, and lateral white segmental lines. Wings green with some scattered darker green irrorations; termen pale greenish yellow inwardly edged by a fine yellow-brown line; cilia greenish yellow. Fore wings: costa greenish yellow; a black discal point. Hind wings: a whitish-yellow streak across end of cell. Wings below greenish white.

Expanse 24 mm.

*Hab.* Tuis.

Between *L. flavolimes*, Warr., and *permagna*, Warr.

Subfam. *ACIDALIINÆ*.*Anisodes aquila*, sp. n.

♀. Body olive-buff, the last three segments of abdomen above bright magenta. Fore wings yellow-buff, finely irrorated with purplish brown; an indistinct dark antemedial line, angled in cell, and marked by purplish points on subcostal, in cell, on median, and on submedian; a fine purplish-red outer line from vein 7, straight and inbent to inner margin, followed by a slightly fuscous shade; subterminal purple-brown points on veins; a fine terminal magenta line, and similar points on interspaces. Hind wings similar, the irrorations partly replaced by purplish striæ, the outer line not reaching costa. Wings below similar, but duller; purplish discal shades; the outer line broader, purplish; the fore wing below cell shaded with purplish.

Expanse 43 mm.

*Hab.* Poas.

*Anisodes erastus*, sp. n.

♀. Head fuscous grey. Collar, thorax, and abdomen pale brownish red. Wings yellow thickly irrorated with brown-red, the lines fine, fuscous grey. Fore wings: costa fuscous grey; antemedial slightly outcurved; a streak on discocellular; veins from cell greyish; postmedial slightly outcurved, vertical from vein 2; outer line oblique from vein 8 to vein 6, then lunular; a subterminal greyish line from costa to termen at vein 4. Hind wings: medial space and veins beyond greyish; a black point on discocellular; postmedial slightly curved; outer line straight from costa to



vein 6, then lunular and closer to termen. Wings below luteous tinged with roseate ; lines faintly marked.

Expanse 22 mm.

*Hab.* Sixola.

*Anisodes peplumaria*, sp. n.

♀. Palpi purplish fringed with pale buff. Head, collar, thorax, base, and tip of abdomen yellow irrorated with red ; abdomen otherwise dorsally fuscous tinged with lilacine. Wings fuscous tinged with lilacine. Fore wings: base yellow irrorated with red, its outer edge inbent from end of cell to inner margin at antemedial line, which is fine, fuscous, and slightly outcurved ; an outbent fuscous line at base ; a medial line on costa, beyond which are some yellowish irrorations ; postmedial fine, black, lunular, deeply outcurved and barely visible on dark ground-colour ; outer line fine, lunular, oblique to vein 4, then inbent, followed by yellow to termen, but cut by dark veins, and greatly reduced before apex by a broad fuscous line from costa to termen at vein 4. Hind wings: base and termen from below vein 4 to anal angle yellow irrorated with red ; a black discal point ; traces of a postmedial and subterminal black line ; a few black scales postmedially below vein 3. Wings below purplish ; the yellow spaces on termen whiter ; the base suffused with roseate yellow.

Expanse 24 mm.

*Hab.* Sixola.

*Anisodes scriptilinea*, sp. n.

♀. Frons lilacine brown, Vertex, collar, thorax, and base of abdomen deep yellow irrorated with red ; abdomen otherwise lilacine white irrorated with yellow and reddish brown. Wings yellow, the lines purplish. Fore wings thinly irrorated with red, rather more thickly on basal half ; a basal line ; antemedial line outbent on costa, then vertical, preceded by a short line in cell ; a lilacine grey line on discocellular edged with purple, and a spot above it on costa ; postmedial fine, outcurved, straight and slightly outbent from vein 2, below discocellular, to inner margin ; outer line outbent, wavy, lunular, and incurved from vein 4 ; a heavy straight line from costa before apex to termen at vein 4 ; a terminal lunular line, veins finely greyish. Hind wings more heavily irrorated with red, except on medial space which is lilacine grey, and encloses a small

yellow, red, and black discal spot; antemedial line wavy; postmedial outbent between veins 4 and 3; outer line oblique to vein 4, then lunular and subterminal; a fine line from costa to termen at vein 4; the veins on outer half fuscous grey. Wings below tinged with red; the lines fine, faintly indicated.

Expanse 24 mm.

*Hab.* Sixola.

*Anisodes silas*, sp. n.

♂. Palpi whitish buff edged above at base with magenta. Head, body, and wings pale yellow; terminal half of abdomen whiter, and with a few dark red hairs. Wings irrorated with reddish-brown points connected by ochreous-yellow shades, forming short striæ. Fore wings: two dark superposed points on costa beyond base; black points on subcostal, in cell, on median and submedian, connected by a fine ochreous-yellow antemedial lunular line, inbent from subcostal; a white point circled with purple-brown at end of cell, followed by an oblique dark line, faintly lunular, from costa to middle of inner margin; a fine outer lunular line marked by dark points on veins; a fine subterminal lunular shade, the lunules outwardly filled with clearer yellow; terminal dark points on interspaces. Hind wings: a fine antemedial wavy line; a dark transverse shade from costa beyond middle to middle of inner margin, crossing the discocellular spot which is white, broken into three parts by some dark shading; outer and subterminal line, also terminal spots, as on fore wing. Underneath whitish yellow, the lines as above, purplish; a similar faint shade on fore wing along median and between veins 3 and 4 to subterminal.

Expanse 36 mm.

*Hab.* Juan Vinas, Tuis, Poas.

*Anisodes sopater*, sp. n.

♂. Body above roseate brown, the third and fourth segments of abdomen dorsally purplish; underneath luteous. Wings roseate brown; minute subterminal black points on veins; fine terminal points on interspaces; a very faint postmedial smoky shade. Fore wings: a white point on discocellular. Hind wings: a white point edged with black on discocellular. Fore wings below roseate; a fine whitish line on discocellular; a fine darker outer line. Hind wings below yellowish white, the costa tinged with roseate; a fine roseate outer line.

Expanse 29 mm.

*Hab.* Juan Vinas, Tuis.

*Anisodes tertullus*, sp. n.

♀. Palpi and head fuscous brown. Body and wings deep yellow thickly irrorated with red; a dorsal line on abdomen, and lines on wings fuscous. Fore wings: costa fuscous; a fine antemedial line, slightly curved; a line on discocellular; postmedial slightly outbent to vein 4, angled and inbent to below discocellular, then downturned; subterminal fine, lunular; veins tinged with fuscous brown, irrorated with yellowish; cilia purplish. Hind wings: a small white spot at end of cell, dark-edged; postmedial straight from costa to vein 4, angled and upturned and outbent to middle of inner margin; subterminal fine, lunular. Wings below roseate yellow, the lines faintly indicated.

Expanse 30 mm.

*Hab.* Juan Vinas.

*Anisodes timotheus*, sp. n.

♀. Palpi whitish buff, the second joint streaked above with purple-red. Frons whitish, edged with dark brown above. Vertex, collar, thorax, and wings lilacine buff with brownish striæ; a fuscous line on collar in front. Wings: lines dull olive-green irrorated with black; outer line lunular, outcurved; traces of subterminal dull greenish shades, veins terminally so shaded; terminal black points. Fore wings: costal margin dark olive, with fuscous-brown irrorations; antemedial line outcurved to below cell, then outbent; an oblique narrow oval line at end of cell; postmedial sinuous, nearly vertical; two small subterminal black spots between veins 4 and 6. Hind wings: a black point at base; antemedial lunular, outangled near inner margin; an oval black spot containing a white point on discocellular; medial line fine; outer line a continuation of medial line on fore wing. Wings below yellowish white; fore wings with lines and striæ purplish red; hind wings with faint traces of outer line and a few striæ on costa; terminal points reddish.

Expanse 27 mm.

*Hab.* Juan Vinas, Tuis, Guapiles.

Very near *A. spissata*, Warr.

*Anisodes transecta*, sp. n.

♂. Body above olive-grey; abdomen pale buff terminally and with a lateral purple-red streak about middle. Wings whitish buff, shaded and striated with light brown. Fore wings: costal margin olive-grey, irrorated with fuscous; a

reddish-brown line from base along median and close above vein 4 to termen, crossed by a similar line from costa near apex to middle of inner margin, both partly shaded with dark grey; a curved antemedial line in cell and a short line from cell, inset; a reddish-brown annular spot at end of cell containing lilacine scales; an outer, wavy, reddish-brown line from vein 8 to just below 4, and a similar point on vein 3; termen mottled with dark grey and red-brown from line at vein 4 to near 6; olive-grey shading and reddish irrorations from vein 4 to tornus; terminal dark points. Hind wings: a fuscous basal streak; a fine red-brown antemedial line and broader medial line, suffusing below costa, diverging on inner margin, the latter followed by olive-grey shading and a silvery-white point on discocellular; outer line fine, reddish brown from vein 6 to inner margin; termen broadly fuscous grey from near vein 4 to inner margin. Underneath whitish yellow, with few striæ; the lines fuscous, less distinct; the outer line punctiform.

Expanse 37 mm.

*Hab.* Juan Vinas.

*Anisodes trophinus*, sp. n.

♀. Body and wings deep yellow, irrorated with red; a black dorsal patch, irrorated with white near base of abdomen; lines fine, black; a subterminal deeply lunular dentate line; an interrupted terminal red line; a fine black and red line on discocellulars; some black mottling on cilia at veins. Fore wings: antemedial line twice outcurved to submedian; a lunular postmedial line, incurved below vein 3 and thickened on veins. Hind wings: subterminal line irregular, angled at vein 4. Wings below yellow, shaded with red; the subterminal line well marked.

Expanse 33 mm.

*Hab.* Juan Vinas.

*Anisodes tychicus*, sp. n.

♀. Palpi buff, edged with purple above. Frons purple. Vertex fuscous. Collar and thorax red. Abdomen above red at base, otherwise purplish; underneath luteous. Wings reddish orange, thickly striated with red; a faint subterminal lunular line, marked by dark points on veins; terminal purplish points on interspaces. Fore wings: costa and inner margin dull purplish brown; antemedial line slightly outbent, dark red; a white point at end of cell, closely followed by a broad medial reddish shade, interrupted



by a dull greyish-brown shade just below cell, this shade extending on veins 3 and 4 to termen. Hind wings: a fine subbasal line; a large white spot at end of cell, followed by a transverse dark shade; veins 3, 4, 6, and 7 heavily shaded with dull greyish brown. Wings below pale yellowish, shaded with roseate purple; medial shade and subterminal line well marked; discocellular spots dull white, on fore wing linear.

Expanse 33 mm.

Hab. Juan Vinas.

*Anisodes vineotincta*, sp. n.

♀. Body above brownish red, underneath yellowish buff, the legs partly dull roseate. Wings dull brownish red, with scattered white striæ; veins fuscous; subterminal white points on veins. Fore wings: a round white spot at end of cell, edged with fuscous. Hind wings: a large round white discal spot, edged with fuscous and containing an interrupted fuscous ring, within which the white is tinged with yellow. Wings below thinly scaled, whitish buff, tinged with roseate; a postmedial sinuous red line; an indistinct fine red subterminal line; termen with reddish striæ.

Expanse 35 mm.

Hab. Juan Vinas, San José.

*Heterephyra directilinea*, sp. n.

♀. Body and wings brown, thickly irrorated with reddish, the lines purplish red. Fore wings: the antemedial line outcurved on costa and slightly outbent, very distinct; postmedial line straight, distinct; outer line finer, twice outcurved; a minute white discal point, dark-edged. Hind wings: a white discal spot, dark-edged; postmedial line straight; outer line wavy. Wings below yellowish, tinged with pale roseate brown; black streaks on discocellular; postmedial line straight, fuscous; outer line dentate, wavy, without the pronounced curves of upper side.

Expanse 35 mm.

Hab. Juan Vinas.

Closely allied to *H. ladrilla*, Dogn.

*Heterephyra johannis*, sp. n.

♂. Palpi reddish brown, fringed below with pale buff. Frons below dark brown, shading to black above and on vertex. Collar, thorax, abdomen, and wings brown, tinged

with red and finely irrorated with fuscous. Fore wings: the costa darker shaded; lines fine, fuscous; antemedial slightly angled on median; postmedial vertical to vein 4, inbent to vein 2, and vertical to inner margin; outer line finely wavy lunular, inbent at vein 3 and vertical below it; a small white discal spot. Hind wings: a black discal point, edged with grey; postmedial bluntly angled at vein 4; outer line curved, finely wavy, indistinct. Wings below roseate brown, with faint traces of postmedial and outer lines.

Expanse 32 mm.

*Hab.* Juan Vinas.

Allied to *H. fuscicosta*, Warr., but differently coloured.

*Dichromatopodia masinissa*, sp. n.

♂. Head, thorax, and wings reddish brown, finely irrorated with buff; discal spots small, whitish and fuscous grey; a fine outer buff line, faintly curved; a medial fuscous shade. Fore wings: a fine buff antemedial line, angled on subcostal. Wings below pale reddish brown; a medial dark line; a fine purplish-red outer line. Abdomen fuscous brown.

Expanse 26 mm.

The female has the base and outer margin tinged with dark purple, and some fuscous shading following outer line.

*Hab.* Juan Vinas, Cartago.

*Dichromatopodia micipsa*, sp. n.

♂. Body and wings reddish brown, irrorated with greyish buff; veins slightly yellowish; discal spots small, mottled grey and black; an outer nearly straight buff line, inwardly edged with slightly darker brown. Fore wings: an antemedial buff line, angled on subcostal, then straight to inner margin. Wings below luteous, shaded with pale red; cilia purplish; a faint reddish outer line.

Expanse 25 mm.

*Hab.* Juan Vinas.

Very similar to *D. miniata*, Dr., which has a white line on discocellular.

*Dichromatopodia orbona*, sp. n.

♀. Body and wings purplish brown. Fore wings: costa dark-shaded; a fine antemedial purple-red line, inwardly edged with dark grey, outwardly oblique from costa; a small white spot on discocellular; outer line heavily marked,

fuscous brown, outwardly edged with ochreous grey, from costa near apex to middle of inner margin on hind wings; the ochreous-grey shade on hind wing is followed by a fine black line. Wings below dull roseate, the outer line less conspicuous.

Expanse 24 mm.

*Hab.* Tuis.

Subfam. *LARENTIINÆ*.

*Cambogia citriaria*, sp. n.

♀. Head and collar orange-brown; a white line between antennæ. Thorax and abdomen yellow, spotted with orange-brown. Wings bright yellow, crossed by broken orange-brown lines; the small discal spots distinct on a clear yellow shade preceding the postmedial fascia, which is broad, tinged with dull lilacine grey, and striated with yellow, its inner edge slightly curved, its outer edge on fore wing incurved beyond cell and below vein 2; this fascia is followed by a narrow clear yellow shade; the lines on outer space are darker yellow, edged with orange-brown, and irregularly confluent. Hind wings: the outer edge of postmedial fascia expands between veins 2 and 4. Wings below pale yellow, the markings purplish. Fore wings: an antemedial shade; postmedial shade broad, outlined as above, followed by a fine line and heavier subterminal line; terminal points between the veins. Hind wings: the postmedial shade narrow; a subterminal line; discal spots on both wings.

Expanse 21–23 mm.

*Hab.* Juan Vinas, Tuis.

Intermediate between *C. odatis*, Dr., and *C. numeria*, Dr.

*Hammaptera caribbea*, sp. n.

♀. Body and fore wings pale green. Fore wings: sub-basal fascia consisting of three black lines on a greenish-brown ground; antemedial space clear, with faint traces of a line and dark spot on costa; medial fascia consisting of four black lines on greenish brown; a dark line on discocellular; postmedial geminate, irregular, somewhat incurved opposite cell, followed by two outer lines, the inner one more heavily marked, indentate between veins 6 and 5, outcurved and punctiform on veins and fold; another line suffuses with the brown shadings preceding the subterminal lunular whitish line, these shadings being blacker and heavier above and below vein 5 and at vein 7; terminal geminate black

points at veins. Hind wings dull brownish grey, the outer margin darkest. Wings below yellowish white; black discal points; three wavy postmedial lines; the outer margins broadly black; cilia greenish yellow, spotted with black on fore wings.

Expanse 32 mm.

*Hab.* Sixola, Banana River, Alajuela.

The male has anal fold to near base filled with long creamy tufts.

*Hammaptera fartaria*, sp. n.

♂. Body greenish mottled with brown; black segmental lines on abdomen, edged behind with grey. Fore wings to outer line dark green; subbasal, medial, and postmedial fasciæ dark brown, edged and crossed by still darker lines, starting from three black lines on costa, the medial and postmedial suffusing shortly below cell; a narrower antemedial fascia marked by two lines; outer line white, strongly marked, slightly incurved between veins 6 and 4, then lunular, projecting somewhat between 4 and 3, inwardly shaded with dark green and outwardly edged by a green line from costa to vein 6 and between veins 4 and 3; terminal space broadly light green, crossed by some darker lunular lines, and with fuscous-brown shadings on costa, from vein 3 to tornus, and above vein 4, the latter having its anterior edge oblique and shaded with reddish brown. Hind wings slate-colour, without fovea or long hairs in fold. Wings below fuscous; black discal points. Fore wings: an outer white fascia from costa to vein 4, angled and less distinct, but expanding and better marked on inner margin; apex white; a terminal white spot between veins 3 and 4. Hind wings: a narrow outer whitish line.

Expanse 38 mm.

*Hab.* Juan Vinas, Sitio.

*Hammaptera herbosaria*, sp. n.

♂. Palpi green, mottled with fuscous. Head and body green, collar with a transverse fuscous shade; patagia heavily shaded with fuscous brown; abdomen with transverse black shades, most distinct on three basal segments. Fore wings bright green; a subbasal dark green fascia, somewhat constricted below cell, edged by fine black lines and crossed by two fine dark brown lines; antemedial space crossed by a geminate dark green line, and a fine single line before medial fascia, which is similar to subbasal, but its



outer edge is lunular below cell and touches the inversely lunular postmedial on vein 2, on fold, and not quite on submedian; postmedial fuscous brown, geminate, wavy, and outcurved beyond cell; a fuscous line edged with pale green on discocellular; postmedial followed by a fine indistinct dark green line; a geminate outer line, the inner portion heavily shaded with black from costa to vein 4, and on veins otherwise; a lunular subterminal pale green line, preceded by fine geminate lines and outwardly partly edged with black; a terminal black line; cilia green, spotted with fuscous green. Hind wings dark slate-colour; the fovea above anal angle whitish, shaded with roseate buff; a terminal black line and pale points at veins; cilia brown, tipped with grey. Wings below whitish, finely irrorated with black; black discal lines. Fore wings: an antemedial small black spot on costa; postmedial and outer fuscous lines angled at vein 4 and not reaching inner margin, which is broadly clear white; termen broadly fuscous, a whitish shade at apex and terminally between veins 3 and 4. Hind wings: fine postmedial and outer black lines; a broad marginal black shade, partly mottled with white terminally.

Expanse 35 mm.

*Hab.* Juan Vinas.

*Hammaptera linusaria*, sp. n.

♂. Palpi light brown, joints tipped with white. Head and abdomen cream-colour, the latter with fine pale brown transverse lines. Thorax grey; patagia streaked with black. Fore wings white, irrorated with brown; medial space brown; termen shaded with brown; a subbasal brownish line, edged with black irrorations; a fine brownish antemedial line, preceded and followed by a less distinct line; the medial space inwardly edged by a wavy black line and outwardly by angled black lines on veins, also crossed by black lines, suffusing below black discocellular line, forming spots to inner margin; a subterminal lunular white line, preceded by black spots above and below vein 5; terminal geminate black spots at veins. Hind wings whitish, the termen rather broadly dark grey. Wings below whitish, the outer margin broadly fuscous grey; fine discal streaks, more pronounced on fore wing.

Expanse 24 mm.

*Hab.* Esperanza, Tuis, Banana River, Avangarez.

The description is taken from a specimen with medial space heavily marked, some specimens having it much greyer, with

only its margins darker; this is especially the case in the females. The species is very similar to *H. tenera*, Warr., but differs below.

*Coremia apollosaria*, sp. n.

♂. Body brownish grey; abdomen with transverse dark brown shades and whitish segmental lines. Fore wings grey; base and medial space light reddish brown, the termen shaded with grey-brown; basal space edged by a darker line; two fine antemedial lines; the medial space crossed by fine darker lines before and beyond the black point on discocellular, the last line vertical from costa to vein 4, outangled, and slightly inbent; postmedial space whitish, with geminate black points on veins; apex greyish, with an oblique terminal fuscous shade below it. Hind wings whitish; a minute point on discocellular; postmedial lines very faint; some grey-brown shading at anal angle. Wings below greyish, with faint traces of lines; minute discal points and some scattered irrorations on hind wings.

Expanse 24 mm.

The female has the medial space broader and deep reddish brown.

*Hab.* Poas, Turrialba.

*Coremia discataria*, sp. n.

♂. Body slate-grey; abdomen with paler segmental lines. Fore wings slate-grey; a medial and a postmedial broad brownish fascia, suffusing below a large pale patch at end of cell and crossed by indistinct fuscous lines, the outer edge of postmedial finely paler grey, sinuous; a subbasal curved brownish line and traces of a finer antemedial; traces of a subterminal lunular whitish line, preceded by brownish shadings, all very indistinct; traces of an interrupted terminal fuscous line. Hind wings grey; three sinuous, fine, medial fuscous lines, and traces of other lines on inner margin close to anal angle. Wings below greyish; black discal points; three fine postmedial fuscous lines. Hind wings thinly irrorated with fuscous and reddish brown.

Expanse 26 mm.

*Hab.* Poas, Turrialba.

*Coremia lucasaria*, sp. n.

♂. Body brown; some black irrorations on abdomen. Fore wings: basal and outer thirds yellow-brown; medial

space fuscous brown; basal space crossed by indistinct darker lines; medial space broad on costa, narrower below vein 4 and cell, its inner edge outcurved, shaded with white on costa, its outer edge serrate, vertical to vein 4, projecting, slightly inbent, with darker streaks on veins 2-4 and some white shading on costa; veins on postmedial space irrorated with fuscous and whitish; subterminal black spots from veins 4-8, partly edged with white; an interrupted terminal black line. Hind wings grey-brown; a broad medial shade, slightly darker. Wings below greyish; outer third of fore wing and entire hind wing irrorated with reddish; minute black discal points.

Expanse 23 mm.

*Hab.* Turrialba.

*Coremia zenasaria*, sp. n.

♂. Head, collar, and thorax greyish brown. Abdomen dark grey, mottled with black and crossed by pale segmental lines. Fore wings grey-brown, rather browner on medial space; a black discal point; lines fine, fuscous, slightly outcurved; a basal, two subbasal, two antemedial, three medial, three postmedial; the outer medial and inner postmedial somewhat lunular; a fuscous spot on postmedial above vein 4, not always present; two lunular dark grey outer lines marked with black points on veins; subterminal whitish, more distinct from veins 4-8, and inwardly shaded with black; an interrupted terminal black line. Hind wings greyish; a black point on discocellular anteriorly; three fine medial and two subterminal fuscous lines. Wings below grey; hind wings and costa of fore wings shaded with lilacine brown; black discal points; the lines faintly marked; the outer postmedial line most distinct.

Expanse 20 mm.

*Hab.* Turrialba.

*Anapalta artemas*, sp. n.

♂. Head and collar brown. Thorax brown; patagia mottled black and grey. Abdomen brown, with black dorsal spots. Fore wings dark brown; a subbasal lunular black line; a broad antemedial whitish fascia, irrorated with light brown; medial and postmedial space with some lighter brown irrorations; two medial black lines and two postmedial lunular lines, black on costa, otherwise fuscous brown, and followed on costa to below vein 7 by a brownish-white shade, less so on inner margin; outer space lighter brown,

with a faint subterminal pale lunular line, preceded by a black shade at vein 6; an interrupted terminal dark brown line. Hind wings greyish, with traces of two lunular dentate postmedial lines, closer together on inner margin; a terminal fuscous line. Fore wings below fuscous grey; the outer margin and hind wings brownish white; black discal points; the two postmedial lines finely lunular dentate; two converging lines from costa before apex of fore wing.

Expanse 26 mm.

*Hab.* Poas.

This species shows considerable variation, especially in the intensity of the antemedial fascia.

*Perizoma pudens*, sp. n.

Palpi and body black-brown, except terminal half of abdomen, which is light grey. Fore wings light silky grey; basal fourth dark brown, crossed by two fine black lines, starting from indistinct fuscous-grey spots on costa; a faint fuscous spot at end of cell; a postmedial and a smaller subterminal dark brown spot on costa; a faint postmedial darker shade and some dark points on veins; termen irregularly and faintly shaded with brown; cilia fuscous grey. Hind wings whitish grey.

Expanse 17 mm.

*Hab.* Turrialba, Poas.

Near *P. fallax*, Warr.

*Perizoma tetrica*, sp. n.

♂. Palpi and frons black-brown, vertex paler, shaded with grey behind. Collar and three terminal segments of abdomen whitish grey; abdomen otherwise and thorax black-brown. Fore wings: basal third fuscous brown, crossed by three fine wavy black lines, the outer two edged with grey on costa; outer two-thirds pale grey shaded with fuscous grey at end of cell, terminally, and broadly on inner margin from postmedial line to tornus; a quadrate dark brown postmedial spot on costa, from which are two fine and interrupted dark lines, slightly incurved, and macular on inner margin; a subterminal broad fuscous-brown shade from costa to near vein 6; a terminal black line interrupted by pale spots on veins; cilia grey partly shaded with black. Hind wings dark silky grey-brown; the dark postmedial line of underside partly visible. Wings below dark silky



grey; black discal spots. Hind wings: the postmedial fuscous line angled below vein 4.

Expanse 13 mm.

*Hab.* Juan Vinas.

*Eriopygidia myrtusaria*, sp. n.

♀. Palpi brownish ringed with white. Head whitish buff, possibly faded green. Collar and thorax dark green. Abdomen orange-yellow. Fore wings sage-green, lines black-brown, thick; an irregular subbasal line; antemedial outcurved from subcostal to fold, preceded on costa by a short line; medial broad on costa, oblique and angled near discocellular and suffusing with the inbent postmedial, the two lines diverging to vein 2, from which to inner margin they are connected by dark brown lines forming four green spots between them; a costal spot between medial and postmedial, from which a darker green shade extends to and on discocellular; an outer line, replaced from between veins 7 and 6 to between 5 and 4, and also from below vein 3 to below 2, by a pale brownish shade; a dentate bluish-green subterminal shade partly shaded outwardly with black-brown; cilia with large black spots at veins. Hind wings orange, the base and inner margin clouded with fuscous, and similar subterminal clusters of scales; the spots on cilia smaller, not reaching apex. Underneath pale olive-brown; fine dark discal streaks; faint traces of a darker postmedial shade, and a subapical shade on fore wings.

Expanse 38 mm.

*Hab.* Poas.

Near *E. narangilla*, Dogn.

*Psaliodes demasaria*, sp. n.

♂. Palpi grey. Head brown. Collar, thorax, and abdomen brown mottled with white. Fore wings chocolate-brown, darkest between medial and postmedial lines and on outer margin; an antemedial white fascia, crossed by a brown line and expanding on inner margin to medial line, which is lunular, the lunules incurved, preceded by a small white spot on costa; an oblique fuscous streak on discocellular; postmedial white, irregularly outbent from costa, sharply inturned at vein 3 to cell, expanding on inner margin, where it is crossed by a brown line, and followed on costa by an inbent white line to vein 6; subterminal white markings on costa, between veins 4 and 2, and at tornus; base of

cilia black spotted with buff, terminally paler. Hind wings greyish brown; cilia spotted at base with dark brown. Fore wings below greyish brown, darker shaded apically; white points on costa, and similar irrorations on termen; post-medial whitish shadings below costa; an outer lunular velvety brown line edged with white outwardly. Hind wings below brownish thickly mottled and irrorated with white; a round yellowish spot at end of cell partly edged with dark brown; a deeply lunular dark brown outer line from costa to vein 3; a postmedial dark brown spot on inner margin.

Expanse 18 mm.

*Hab.* Volcano Turrialba.

*Psaliodes claudiaria*, sp. n.

Palpi, head, and thorax brown; the abdomen paler, with dark transverse shades posteriorly, edged dorsally by white segmental lines. Fore wings brown; a darker inbent sub-basal line, faintly edged with white outwardly; a medial white line, slightly inbent, edged with dark brown, more broadly outwardly; a postmedial white line, also edged with dark brown and followed by a whitish line outbent above vein 5 to apex; this outbent line edged by a fuscous shade, which is irregularly outbent below vein 5 to termen at vein 3; the terminal space from vein 3 to apex shaded with grey-brown; a terminal fuscous line; cilia yellowish spotted with fuscous. Hind wings whitish, the termen faintly shaded with brown; a terminal dark line; cilia yellow. Hind wings below white striated with grey-brown; the veins partly yellow; a dark discal point; a postmedial curved brown line, inangled at vein 3.

Expanse 18 mm.

*Hab.* Juan Vinas.

*Psaliodes crispata*, sp. n.

♂. Palpi, head, collar, and thorax brown. Abdomen silvery grey at base with brownish irrorations; dorsum shaded with dark brown terminally. Fore wings: base brown, becoming darker before antemedial line, which is white, inset from median to inner margin; space to medial line dark brown, thinly irrorated with pale brown and shaded with white along subcostal; medial line broad, white, its edges incurved and crossed from subcostal by a fine wavy brown line; space to postmedial dark brown, its outer edge deeply lunular; postmedial white, the space beyond pale

brown, mottled with white towards apex and crossed near postmedial by whitish lunules; a broad terminal dark brown space from vein 7-4, inwardly edged with whitish, and dark marginal lunules below 4 and below 3; cilia dark brown spotted with yellowish. Hind wings whitish grey; cilia pale yellowish with dark spots at veins. Fore wings below greyish, with traces of whitish lines; a vermilion streak above subcostal from base to medial line, then below subcostal and along vein 8 to apex. Hind wings below whitish striated with brown; a dark brown line on discocellular; a dark outer dentate line, inset at vein 3.

Expanse 19 mm.

*Hab.* Poas.

*Psaliodes infulata*, sp. n.

♀. Palpi and frons brown. Vertex, collar, and thorax yellowish buff, the collar and patagia anteriorly shaded with dark brown. Abdomen light brown with pale segmental lines. Fore wings: base yellowish buff mottled with brown, shading to dark brown at antemedial line, which is white, vertical, indentate on submedian; space following yellowish buff mottled with brown; medial and postmedial lines white inversely lunular edged with dark brown, the space between them filled in with irregular dark brown blotches at end of cell, and from vein 2 to inner margin, otherwise lighter brown shaded with yellowish buff; postmedial line followed by a straight yellowish-white shade; outer space brown, paler shaded; a terminal dark brown space, very broad between veins 4 and 6, narrowing to apex, and similar lunules below vein 4 to tornus; cilia yellowish spotted with fuscous brown. Hind wings whitish grey, shaded with pale brown on outer half. Fore wings below fuscous grey, the costa shaded with orange. Hind wings below yellowish white, striated with grey, chiefly at base and on outer third; a brown discal spot and sinuous postmedial line.

Expanse 23 mm.

*Hab.* Cachi.

*Psaliodes interstrata*, sp. n.

♀. Palpi and frons light brown. Vertex white. Collar and thorax whitish buff shaded with brown. Abdomen pale brown with whitish segmental lines, edged with dark brown. Fore wings white striated with brown except on lines, which are rather broad and with nearly straight edges; antemedial line inbent, inwardly edged with dark brown; medial line

inbent, the space to postmedial line dark brown from costa to median, and from vein 2 to inner margin; postmedial line inbent below vein 4, its outer edge suffusing somewhat with ground-colour; some terminal dark brown shading, chiefly above vein 4 to apex; cilia yellowish white spotted with dark brown. Hind wings white, the termen shaded with pale brown. Fore wings below fuscous grey; a white medial spot across cell, and one above inner margin; the postmedial line and subterminal markings white, distinct. Hind wings below white striated with brownish grey; a dark streak on discocellular; a fine dark postmedial line, slightly sinuous.

Expanse 21 mm.

*Hab.* Poas.

*Psaliodes philetus*, sp. n.

♀. Palpi brown. Head, collar, and thorax olive-brown, with paler mottlings; a dark brown spot on patagia. Abdomen whitish buff, finely irrorated with brown. Fore wings olive-brown; the lines white, divided by a fine dark brown line; the antemedial sinuous, the medial and postmedial inversely lunular; a fuscous-brown streak on discocellular, and dark brown shade beyond it; a subterminal lunular dark brown line, almost touching postmedial between veins 4 and 6, and outwardly shaded with dull fuscous brown to termen; some yellowish striæ on costa and outer space; cilia alternately black and yellow. Hind wings whitish, outwardly shaded with brown; a faint fuscous medial line; cilia yellow, with fine fuscous streaks at veins. Hind wings below yellowish white striated with greyish brown; a black discal spot followed by a fuscous-brown line, broad on inner margin and barely reaching costa.

Expanse 27 mm.

*Hab.* Poas, Turrialba.

Near *P. aurantivena*, Warr.

*Psaliodes simplex*, sp. n.

♂. Palpi dark brown fringed above with white. Head, collar, patagia, and abdomen purplish grey; thorax dark reddish brown. Fore wings purplish grey, with a few scattered whitish irrorations; a fine subbasal dark brown vertical line; inner and outer lines fine, yellowish white, broadly edged on medial side with dark reddish brown, the inner line faintly inbent, the outer line vertical on costa, outangled on vein 6, where a faint brown shade extends to apex, and parallel with outer margin from vein 6 to inner



margin; terminal yellowish points at veins; cilia fuscous on basal half, outwardly white spotted with fuscous. Hind wings dull roseate, terminally shaded with lilacine grey; a straight brownish outer line; cilia fuscous grey partly tipped with white. Fore wings below roseate brown; traces of inner and outer lines; costa and termen fuscous grey; a fuscous line on discocellular. Hind wings below roseate brown, the termen shaded with fuscous grey; a black line on discocellular; a broad yellowish outer line edged with dark reddish brown.

Expanse 18 mm.

*Hab.* Carillo.

Near *P. cronia*, Dr., and *P. acutangula*, Warr.

*Psaliodes sutum*, sp. n.

♀. Palpi whitish outwardly shaded with roseate brown. Head and collar whitish divided by a purplish line. Thorax and abdomen purplish brown, the latter with slate-colour segmental lines. Fore wings brown faintly tinged with purple; a broad inner fascia, dull greyish, shaded with ochreous brown on costa, edged by white lines, and crossed by a faint similar line, its inner edge angled in cell, its outer edge straight and inbent; a fuscous shade on discocellular; a faint postmedial darker brown line, irrorated with grey, outcurved beyond cell, dentate from vein 3 to inner margin, the space beyond it broadly clearer brown crossed by a faint darker line; cilia dark brown, irregularly tipped with white. Hind wings white, the termen shaded with roseate brown; a black discal point. Wings below roseate brown. Fore wings: a black streak on discocellular. Hind wings: a black discal point broadly edged with white; a lunular postmedial whitish line.

Expanse 20 mm.

*Hab.* Poas.

Allied to *P. bicolor*, Prout.

Subfam. *ÆNOCHROMINÆ*.

*Dolichoneura eriphyle*, sp. n.

♂. Palpi and head fuscous brown. Thorax slate-grey. Abdomen brownish slate; dorsal white points. Wings slate-grey; a terminal fine black line; cilia light brown. Fore wings: an antemedial pale brown line, broadest in cell and on costa; a pale brown wavy outer line, shaded on either

side with buff, slightly incurved opposite cell and below vein 2; terminal space shaded with buff except at apex; a dentate lunular subterminal greyish shade. Hind wings: an antemedial and a postmedial light brown line; an irregular and faintly marked subterminal greyish line. Wings below dark grey.

Expanse 35 mm.

*Hab.* Tuis.

*Dolichoneura squalida*, sp. n.

♀. Palpi and head dark brown. Body and wings slate-grey; white dorsal points on abdomen. Fore wings: antemedial geminate whitish spots on inner margin; a white discal point; an outer light brown lunular line, angled at vein 6, preceded by a narrow light grey shade, the space beyond to termen being ochreous grey except on costa to subterminal which is slate-grey; an interrupted subterminal lunular dentate slate-grey line partly shaded with whitish grey. Hind wings: a subbasal geminate whitish line, closely followed by the white discal point; a pale brown lunular outer line edged with ochreous grey, somewhat interrupted, and chiefly noticeable on inner margin; faint subterminal whitish spots; cilia dark olive-brown. Wings below dark grey.

Expanse 35 mm.

*Hab.* Juan Vinas, Tuis, Guapiles.

This may possibly be the female of *D. eriphyle*, Schs., in spite of their dissimilarity.

*Phellinodes gratiosa*, sp. n.

♂. Head brown. Collar and thorax mottled grey and white. Abdomen dark grey irrorated with white. Fore wings grey mottled with dark grey and fuscous, the inner margin tinged with brown; costal and outer margins mottled with white except at apex which is occupied by a large dark brown spot inwardly edged by a curved black line and containing some fuscous striæ; a small black spot on discocellular. Hind wings black, slightly mottled with grey on inner margin; a broad white space from base to well beyond cell. Fore wings below: costal margin broadly brownish grey striated with fuscous; a small postmedial white spot; the apical spot more broadly edged with black; a narrow white shade from base above median, expanding between veins 2 and 4 to termen, and terminally irrorated and spotted

with black; inner margin broadly fuscous grey. Hind wings below white mottled with fuscous brown, forming a well-marked subterminal shade; discocellular shaded with fuscous; cilia black spotted with white from vein 4 to apex.

Expanse 38 mm.

Hab. Tuis.

Belongs to Sect. II.

XL.—*Descriptions and Records of Bees.*—XLVI.

By T. D. A. COCKERELL, University of Colorado.

*Trigona ziegleri mayarum*, subsp. n.

Worker.—Agrees with Friese's short account of *T. ziegleri*, except that the hair of the thorax is pale ferruginous, and the head is distinctly wider, fully  $2\frac{1}{3}$  mm. The size also is a little greater, length fully 6 mm. Friese states that the hind tibiae of *ziegleri* are black at apex, in *mayarum* about the apical half is black, and the hind basitarsi are black on outer side. Among the species known to me, *T. mayarum* comes closest to *T. jaty*, Sm.; but the latter is much smaller, with the pleura mainly dark, and the yellow lateral face-marks forming a much more acute angle above. Other characters of *mayarum* are: mandibles with a little tooth at inner corner, but otherwise unarmed; scape very broadly yellow in front; flagellum clear ferruginous beneath, rufo-piceous above; yellow supraclypeal mark an equilateral triangle; front dullish with fine short reddish hair, but smooth and shining below the ocelli; tegulae apricot-colour; wings with a faint orange tint; abdomen apricot-colour, shining.

Hab. Quirigua, Guatemala (*W. P. Cockerell*).

I expect that when this can be actually compared with *T. ziegleri* it will be found to be a distinct species. An allied but larger species is the Brazilian *T. manni*, Ckll.

*Trigona jatiformis*, sp. n.

Worker.—Length  $4\frac{1}{2}$  mm.

Smooth and shining; head and thorax black with pale markings; abdomen clear ferruginous, with a rather narrow black or blackish band along hind margin of first dorsal segment; labrum honey-colour; mandibles edentate, pallid (pellucid whitish) basally, rufous apically;

clypeus yellow, slightly suffused with reddish; triangular supraclypeal mark and lateral marks pale yellow, the latter elongate, pointed above on orbital margin above level of antennæ, but with the inner margin reddish and not sharply defined; scape pale reddish yellow, black above at apex; flagellum dark; mesothorax nude, shining black, with yellow lateral margins; axillæ yellow; hind margin of scutellum yellowish white; tubercles cream-colour; tegulæ pellucid rufo-testaceous; wings hyaline, faintly dusky, stigma and nervures reddish; legs ferruginous; hind tibiæ with apex broadly, and hind margin except at base, black; hind basitarsus with a large black patch; face and front with fine short pale hair, not at all dense.

*Hab.* Quirigua, Guatemala, = type locality, four workers (*W. P. Cockerell*); Puerto Barrios, Guatemala, one, Jan. 28, 1912 (*W. P. Cockerell*).

Looks exactly like *T. jaty*, Smith, but differs at once by the abdomen, which is broad instead of almost linear. Smith's description of *T. jaty* refers to the male, but I have workers with the same narrow abdomen. The new species also differs from *jaty* by the dark flagellum and other small characters.

*Trigona jaty*, Smith.

Amatitlan, Guatemala, Feb. 1912 (*W. P. Cockerell*); Quirigua, Guatemala, two on "common yellow Compositæ," one at flowers of *Zexmenia virgulta*, Klatt, one Feb. 11, on plant no. 15 (*W. P. Cockerell*).

*Trigona mellaria*, Smith.

Gualan, Guatemala, one Feb. 23, at flowers of *Calopogonium cæruleum*, Desv., Feb. 23 (*W. P. Cockerell*); Quirigua, Guatemala, one (*W. P. Cockerell*, 7).

*Trigona stigma*, Smith.

Quirigua, Guatemala, one (*W. P. Cockerell*). New to Central America.

*Trigona nigerrima*, Cresson.

Quirigua, Guatemala, sixteen (*W. P. Cockerell*). Taken at sap, and at flowers of *Pontederia cordata*, L. (Feb. 11), *Ipomæa sidæfolia*, Choisy (Feb. 20), and *Centrosema plumieri*, Benth. (Feb. 13). This is smaller than *T. silvestriana*, Vachal. Is it possible that the "*silvestriana*" reported by Vachal from British Honduras was *nigerrima*?



*Trigona argyrea*, sp. n.

Worker.—Length slightly over 3 mm.

Black, including antennæ and legs, but abdomen (which is short and rather broad) shining dark sepia-brown; head large; face up to antennæ flattened, densely covered with short, appressed, brilliantly silver hair; mandibles edentate, black with the apical margin rufous; cheeks small; front shining, the upper part with rather large sparse punctures, as they appear under a lens, but the microscope shows that they are the bases of black bristles; vertex with black hair; posterior ocelli very close to occipital margin; thorax narrower than head, without light markings, the dorsum shining, with black hair, the mesothorax also with very short strongly plumose pale hairs; pleura with pale hair; sides of metathorax minutely pale-tomentose; hair of legs largely black, but white hair on underside of middle trochanters and basal half of their femora (hind legs broken off in type); wings dusky, nervures and stigma dark sepia; tegulæ rufo-piceous; underside of abdomen pale ochreous.

*Hab.* Quirigua, Guatemala, one (*W. P. Cockerell*). The specimen is labelled "nest in clay bank," where it was taken along with a couple of *T. cupira*, Smith.

This may be compared with *T. hyalinata*, Lep., and *T. tubiba*, Smith; differing from both by its very silvery face, from *hyalinata* also by the smaller size, and from *tubiba* by the shining front and mesothorax (these parts in *tubiba* are absolutely dull). *T. argentata*, Lep., has silvery hair on face, but the wings are clear.

*Trigona zexmenia*, sp. n.

Worker.—Length  $7\frac{1}{2}$  to 9 mm.

Robust, abdomen parallel-sided, not quite so broad as thorax; head and thorax dull black, but the clypeus and supraclypeal area shining and strongly punctured; labrum ferruginous, more or less bigibbous; mandibles rufo-piceous, edentate, the broad apical margin sharply marked off and ornamented with elongate punctures; malar space rather large; no light face-marks; front dull and densely granular, as also are the mesothorax and scutellum; antennæ black, with the scape red at base and extreme apex, and flagellum dark reddish beneath; hair of head and thorax above scanty and black, longest on scutellum; edge of mesothorax above tegulæ with a narrow dull yellow stripe; hair of pleura mostly black, partly pale below; tegulæ piceous or rufo-piceous. Wings dusky, with a

strong reddish tint; stigma and nervures testaceous. Legs black, the small joints of tarsi dark red; abdomen dull but not dark reddish fulvous, the segments more or less dusky, though narrowly, at apex. The face is very broad.

*Hab.* Quirigua, = type locality, eight; one at flowers of *Zeaxmenia virgulta*, Klatt, two at flowers of common yellow Compositæ, three (Feb. 21) at blue flowers of a species of Labiatae (*W. P. Cockerell*); Gualan, Guatemala, one at flowers of *Vernonia aschenborniana*, Schauer, one (Feb. 18) without flower record (*W. P. Cockerell*).

A relatively large species, looking a little like *Melipona mandacai*, Smith, but the resemblance is merely superficial. It should rather be compared with *Trigona fulviventris*, Guér., which is considerably smaller and has a shining abdomen. The two agree in the dense white tomentum on cheeks.

*Trigona fulviventris*, Guérin.

Mrs. Cockerell took this in Guatemala as follows:—Puerto Barrios, six, Jan. 28; Quirigua, five, two at *Zeaxmenia virgulta*, Klatt, one (Feb. 20) at *Ipomœa quinquesolia*, Grisebach, one (Feb. 11) at *Pontederia cordata*, L.; Amatitlan, February, one; Guatemala City, one.

*Trigona cupira*, Smith.

Mrs. Cockerell took this in Guatemala as follows:—Amatitlan, one; Puerto Barrios, one, Jan. 28; Guatemala City, three (I also have three from Guatemala City collected by Mr. J. Rodriguez); Antigua, one; Gualan, twelve, all but one at flowers of *Vernonia aschenborniana*, Schauer; Quirigua, sixteen, two at nest in clay bank, five (Feb. 12 and 20) at flowers of *Ipomœa sidæifolia*, Choisy.

*Trigona amalthea*, Olivier.

Mrs. Cockerell took this in Guatemala as follows:—Gualan, two, Feb. 22–23, at flowers of *Calopogonium ceruleum*, Desv.; Puerto Barrios, one; Quirigua, five, one (Feb. 11) at *Pontederia cordata*, L., one at flowers of common yellow Compositæ.

*Trigona frontalis flavocincta*, Cockerell, var. *a*.

Quirigua, Guatemala, a variety with lateral thirds of clypeus black or nearly, bases of first and second abdominal segments usually creamy white, the hind margin of first segment very broadly dark; nine workers, one at nest in

clay bank, six at sap, others at flowers of plant no. 7 (*W. P. Cockerell*).

*Melipona fulvipes*, Guérin.

Gualan, Guatemala, one male, Feb. 18 (*W. P. Cockerell*). Near to *M. ligata*, but the male differs. Mrs. Cockerell took workers of *M. fulvipes* at Quirigua, eleven specimens; three (Feb. 20) at flowers of *Solanum*, one (Feb. 11) at *Pontederia cordata*.

*Melipona solani*, sp. n.

Worker.—Length about 10 mm.

Black, with the general build and structure of *M. fulvipes*; face without light markings, except the faintest possible reddish median line on the dull minutely granular clypeus; labrum ferruginous, minutely punctured; antennæ dark, scape rufo-piceous, flagellum reddish at end; hair of head and thorax above abundant, mixed dark fuscous and ferruginous, of sides of thorax rich ferruginous, beneath whitish; mesothorax and scutellum shining, the latter testaceous; tegulæ clear amber-red; wings dusky, very red, especially toward base; stigma and nervures ferruginous; much of middle, and nearly all of hind femora, bright red; apical tarsal joints and end of lobe of hind basitarsus red; hair of legs partly black and partly red, the short appressed hair on inner surface of hind tibiæ with a purple lustre in certain lights; abdomen black with black hair, hind margins of the segments very narrowly obscure reddish (this is wholly wanting on the fifth), and the second and third with a fringe of pale golden-brown hair; venter ferruginous suffused with darker, and with glittering cream-coloured hair.

*Hab.* Quirigua, Guatemala, one at flowers of *Solanum*, Feb. 20, 1912 (*W. P. Cockerell*).

Allied to *M. fulvipes*, but easily known by the lack of yellow bands on the abdomen and of yellow face-markings.

*Augochlora gemmella*, sp. n.

♀.—Length about 6 mm.

Very brilliant shining blue, more green on thorax, varying to nearly all blue-green; in the type the face, vertex, and cheeks are peacock-green, the front blue; thorax blue-green with purple shades, but the scutellum and postscutellum very green, contrasting with the blue metathorax; abdomen blue with purple lights, dorsum of second segment distinctly green; on the legs the blue colour extends to the femora

and anterior and middle tibiæ; labrum black, mandibles with the apical half rufous; clypeus not much produced, strongly but sparsely punctured, its lower margin rather broadly black; antennæ black, scape rufous at extreme base; front minutely granular; cheeks with rather abundant white hair; mesothorax very brilliant, with extremely minute punctures, sparse in middle, becoming dense only at sides; anterior angles of prothorax prominent, greater (but not very much greater) than right angles; hair of thorax scanty and pale; area of metathorax semilunar, with fine plicæ which cover little more than the basal half; apical truncation not distinctly defined above; tegulæ pale rufo-testaceous, with a blue spot. Wings slightly dusky, nervures and the large stigma dark sepia; third s.m. twice as long as second; first r. n. joining second t.-c. on entering basal corner of third s.m.; hind spur with three spines, two very long; hair on inner side of hind basitarsus shining mouse-grey. Abdomen broad, shining, very brilliant, the linear hind margins of the segments reddish; no vibrissæ; much hair on ventral surface of abdomen. The specimens have collected an abundance of white pollen on the hind femora and the under surface of the abdomen.

*Hab.* Quirigua, Guatemala, six females (*W. P. Cockerell*). Three collected Feb. 13, 1912, at flowers of *Centrosema plumieri*, Benth. One at flowers of *Zexmenia virgulta*, Klatt. Two at plant no. 60.

Quite distinct from all other Guatemalan species by the small size and brilliant colours. It belongs to Vachal's group *sericei*, and in his table runs to the much larger and otherwise different *Augochlora tonsilis* (*Halictus tonsilis*, Vachal), except for the long spines on the hind spur. There is quite a close resemblance to *A. cyaneoviridis*, Ashm., from St. Vincent; but Ashmead's species has the area of metathorax covered with fine striæ, the wings browner, the head narrower, and the mesothorax rugulose with dense punctures.

*Augochlora amatitlana*, sp. n.

♂.—Length about 10 mm., anterior wings about 7.

Head and thorax bright blue-green with purple tints, the purple mainly in the form of two suffused longitudinal bands on mesothorax and two spots on scutellum; middle of face golden green; metathorax and postscutellum of the same colour, not so blue as scutellum; a small golden triangle at upper end of metathoracic truncation; head broad above, eyes deeply emarginate, almost without hair; clypeus strongly



produced, shining, rather sparsely punctured, with a little median golden stripe, and the lower margin rather broadly testaceous; labrum brown, pointed below; antennæ black, with a red spot at extreme apex, flagellum very long; front densely granular; mesothorax and scutellum densely granular-punctate; postscutellum large, with indications of longitudinal fluting; area of metathorax large but poorly defined, the middle and base densely wrinkled; posterior truncation sharply defined only at sides below; tegulæ red-brown, with a large green spot and pallid margin. Wings orange-tinted, not dark; the nervures and rather small stigma ferruginous; second s.m. broad, its sides parallel; first r. n. joining second t.-c.; femora and tibiæ green, hind tibiæ black behind; tarsi ferruginous; hind legs long and slender; spurs light ferruginous. Abdomen brilliantly shining, but finely and rather conspicuously punctured, disc of first segments with punctures all over; general colour of abdomen brilliant coppery shading to golden, the middle of the segments (especially the second) reddest, the hind margins broadly pale greenish; thin pale pubescence, especially at sides, but no bands or vibrissæ; underside of abdomen dark green, the third segment broadly emarginate at apex, and the middle beyond the third broadly excavated or hollowed.

*Hab.* Amatitlan, Guatemala, Feb. 1912 (*W. P. Cockerell*).

A magnificent species, presumably one of the *sericei*, but the female is unknown. It seems to be nearest to *A. aurora*, Smith, in which the abdomen is yellowish green and the thorax dark blue-green. It does not agree with anything in Vachal's tables.

*Cænohalictus wilmattæ*, sp. n.

♂.—Length about 10 mm., anterior wings nearly  $8\frac{1}{2}$ .

Eyes with short scanty hair; pubescence very conspicuously plumose; eyes deeply emarginate; head broad, eyes converging below; clypeus much produced, shining blue-green, with scattered strong punctures, lower margin rather broadly dull whitish, the actual edge ferruginous; labrum transverse, rufo-fuscous, the base whitish, the apex angular and fringed with long golden hairs; mandibles black; malar space about twice as broad as long; supraclypeal area with a golden patch in middle; front dark green, very hairy; hair of head and thorax below sordid white, of vertex and dorsum of thorax dull fulvous; cheeks brilliantly purple-blue; thorax dark purple-blue, the pleura richly coloured, the mesothorax and scutellum blackish except at sides, the

middle of mesothorax slightly greenish; metathorax very dark green or greenish black; mesothorax and scutellum densely granular-punctate, almost rugose; anterior corners of prothorax not at all prominent; area of metathorax poorly defined, coarsely rugose-wrinkled at base and middle; posterior truncation quadrate, sharply defined only below, overlapped at apex by the golden-tinted tip of basal area; tegulae rufo-fuscous, with pallid margins and a bluish spot. Wings ample, somewhat dusky, conspicuously so at apex; nervures and stigma ferruginous; second s m. large; first r. n. joining second t.-c. Legs with pale hair, orange-tinted on inner side of tarsi; femora and tibiae mainly metallic blue, hind tibiae black behind; tarsi more or less ferruginous, especially the hind ones. Abdomen closely and finely punctured but shining, golden green, the disc of first segment and base and sides of second faintly flushed with coppery; hind margins of segments suffusedly and rather obscurely blackish; venter of abdomen formed as in *Augochlora amatitlana*; antennae long and black.

*Hab.* Amatitlan, Guatemala, Feb. 5, 1912 (*IV. P. Cockerell*).

This certainly must be quite closely related to *Augochlora amatitlana*, having essentially the same structure and general type of coloration. In detail, however, *A. amatitlana* is very differently coloured. The eyes of *A. amatitlana* are practically hairless, but with the compound microscope I find a very few short hairs. It is a question whether *A. amatitlana* should not stand as *Cenohalictus amatitlanus*; but, on the other hand, it is possible that actual comparison with the type of *Cenohalictus* (from Ecuador) would show that neither of the insects now described should really be referred to it. Certainly they have not the long hair of the eyes of *C. trichiophthalmus*, Cameron. If, however, we redefined *Cenohalictus* as *Augochlora* of the *sericei* group with hair on the eyes, we have four species: *C. trichiophthalmus*, Cam.; *C. chaetops*, Vachal; *C. amatitlanus*, Ckll.; *C. wilmatte*, Ckll. The species of Vachal and Cameron are considerably smaller than those from Guatemala, being only about 8 mm. long.

*Dialictus onustulus*, sp. n.

♀.—Length fully  $5\frac{1}{2}$  mm.

Head and thorax olive-green; clypeus smooth with sparse large punctures, the lower half black, the upper half crimson and green; supraclypeal area tinged with brassy; mandibles red at apex; front dull and densely granular; antennae

black, the flagellum stout ; mesothorax dullish, with minute not very dense punctures ; area of metathorax rugose, hardly plicate ; tegulae small, rufo-piceous. Wings hyaline, faintly dusky, stigma and nervures brownish testaceous ; first r. n. joining second s. m. more than a third from base. Legs black, with pale hair. Abdomen black with a distinct æneous tint, the hind margins of the segments so slightly and narrowly reddish that the fact is hardly noticeable ; no bands, but rather abundant pale hair. The following characters are microscopical : face and front minutely tessellate, sides of front as densely punctured as is possible ; sides of mesothorax (also minutely tessellate) with punctures about as far apart as the diameter of one ; middle of mesothorax with punctures about or nearly twice as far apart ; tegulae with minute piliferous punctures only ; area of metathorax with irregular basal plicae ; abdomen with extremely fine piliferous punctures, sparse but not absent on disc of first segment ; third segment with much beautifully plumose hair ; hind spur with four long teeth. The type carries much yellow pollen.

*Hab.* Guatemala City, Guatemala (*W. P. Cockerell*).

Except for the larger size, this agrees fairly well with the description of *D. costaricensis*, Crawford, but the tegulae are no larger, and the punctures of the mesothorax are not closer, than in *D. occidentalis*, Crawford, from the United States. The insect is nearest to *D. occidentalis*, from which it is known by the brassy or greenish-tinted abdomen and somewhat dusky wings.

*Exomalopsis callura*, sp. n.

♂.—Length 6–6½ mm.

Black, shining ; head broad ; face and front with shining white hair ; labrum with much white hair ; cheeks with white hair, except the uppermost part, where it is black ; occiput with much black hair ; sides of vertex smooth and shining ; ocelli in a very slightly curved line ; no light face-markings ; clypeus and supraclypeal area smooth and flat, with very few minute and feeble punctures ; mandibles black ; scape black ; flagellum normal, black above, bright yellowish ferruginous below ; mesothorax with rather small but strong and close punctures, except the posterior disc, which is impunctate ; hair of thorax black, but a large white tuft on lowermost part of pleura ; tegulae black. Wings hyaline, suffused with orange, the apical margin broadly pale greyish ; stigma and nervures bright apricot-colour, stigma

large ; second s.m. rather large, receiving first r. n. near beginning of its last third. Legs black, the small joints of tarsi ferruginous ; hair of legs mainly black, but partly reddish on middle and anterior tarsi, and some pale glittering hair on anterior side of hind tibiæ and a little on base of basitarsus. Abdomen shining, finely punctured ; first two segments appearing dark, with hair partly black, though broadly pale ochreous at base and sides of first segment, and red at base of second ; third and following segments densely covered with appressed shining red-orange hair.

*Hab.* Gualan, Guatemala (*W. P. Cockerell*).

Three at flowers of *Vernonia aschenborniana*. Nearest to *E. otomita*, Cresson, but colours of abdomen different, wings not yellowish fuscous, stigma not brown, &c.

# XLI.—Three new Species of Neotropical Coccinellidæ.

By GUY A. K. MARSHALL.

## *Azya trinitatis*, sp. n. (Fig. 1.)

Parva, subcyaneo-nigra ; abdomine, pedibus, ore, epistoma rufo-flavis ; supra setulis parvis erectis griseis undique æqualiter vestita.

Black, with a slight dark blue reflection ; the abdomen, legs, mouth-parts, and epistome reddish yellow. The entire upper surface densely and evenly clothed with very fine,

Fig. 1.



*Azya trinitatis*, Mshl.

short, erect, grey hairs, and without any patch or patches of dark hairs. The elytra closely, evenly, and distinctly punctate throughout ; the punctation of the thorax shallower.

*Length* 2.75 mm.



TRINIDAD: Cedros, April 1911 (*F. W. Urich*).

*Type* in the British Museum.

Described from five specimens received by the Entomological Research Committee from Mr. F. W. Urich, Entomologist to the Board of Agriculture, Trinidad. Mr. Urich states that the species is of economic importance, as both the adults and larvæ attack the coconut scale (*Aspidiotus destructor*), upon which they operate as a very serviceable check.

This species may be readily distinguished from all the previously described species of *Azya* by its small size and by the complete absence of any of the characteristic patches of dark hairs.

*Azya nana*, sp. n.

Parva, cyanea, nitida; abdomine, pedibus, ore rufo-flavis; supra setulis griseis subreclinatis vestita, elytris ante medium macula circulari communi setulis fuscis brevioribus suberectis obsita ornatis.

Dark blue, shining; the abdomen, legs, and mouth-parts reddish yellow. The upper surface is densely clothed with fine subrecumbent grey hairs, which are rather longer than those of *A. trinitatis*, and on the elytra there is, before the middle, a common circular patch of rather shorter suberect dark hairs; the front margin of the patch does not quite reach the scutellum, and its hind margin is just behind the middle. The punctuation is very similar to that of *A. trinitatis*, but is distinctly shallower on the disk of the elytra.

*Length* 2.25 mm.

BRAZIL: Pernambuco (*Alexander Fry*).

*Type* in the British Museum.

The two Brazilian species, *A. scutata*, Muls. (3.5 mm.), and *A. nigrina*, Weise (4 mm.), which agree with *A. nana* in having a common patch of dark hairs on the elytra, may be at once distinguished by their much larger size, reddish-yellow epistome, and less strongly punctate elytra, as well as by their different colour—the first-mentioned being black with a dark purplish reflection, and the other entirely black. I have seen sixteen specimens of this species.

*Cryptognatha nodiceps*, sp. n. (Fig. 2.)

Parva, flava, signaturis piceis notata; elytris singulatim litura magna irregulari picea discum fere totum obsidente (*vide* fig. 2) et macula parva elongata longitudinali ante medium juxta suturam ornatis.

Pale yellow or reddish yellow, with a large irregular piceous black patch occupying nearly the whole disk of each elytron, and an elongate longitudinal spot close to the suture before the middle. Head of ♂ broadly impressed, with a small projecting tubercle close to the inner margin of the eye, the epistome broadly truncate anteriorly, its external angles roundly subrectangular and somewhat recurved; in the ♀

Fig. 2.

*Cryptognatha nodiceps*, Mshl.

the head is much less deeply impressed and the tubercles are less conspicuous. Pronotum with a fine, transverse, curved, raised line just in front of the scutellum, the entire surface closely and distinctly punctate. Elytra broadest before the middle, the punctation rather less close than on the pronotum; the epipleuræ sloping steeply inwards and with deep excavations for the anterior pairs of legs. Front tibiæ with the exterior border angularly dilated in both sexes (omitted in the figure); tarsal claws simple.

Length 2.75 mm.

TRINIDAD: Cedros (*C. W. Hewlett, F. W. Urich*).

*Types* ♂ ♀ in the British Museum.

The structure of the head and epistome, as well as the very distinctive coloration, will render this an easily recognizable species. The discal patch on the elytra varies somewhat, the included paler areas being often entirely dark and the outline of the whole patch more sharply defined. Described from six specimens.

As in the case of *Azya trinitatis*, Mr. Urich has found this species to be an effective check on the coconut scale in Trinidad.

XLII.—Description of Two new Eels from West Africa, belonging to a new Genus and Family. By C. TATE REGAN, M.A.

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*HETERENCHELYS*, gen. nov.

Naked, elongate, subcylindrical, with the tail much longer than the trunk. Dorsal and anal fins long, but very low except towards the end of the tail, where they are confluent with the caudal; rays concealed beneath the skin; no pectorals. Gill-openings separate, placed low. Nostrils lateral, the posterior in front of the very small eye. Mouth moderate; teeth conical, biserial in jaws and on vomer; tongue not free; pharyngeal apertures of branchial clefts wide; pharyngeals covered with small teeth.

Very similar to *Moringua*, which has the trunk much longer than the tail, the teeth uniserial, and the pharyngeal apertures of the interbranchial clefts small. A study of the anatomy confirms the relationship to *Moringua*, but reveals some important differences, notably that the heart is placed just behind the gills and the palato-pterygoid is well developed in *Heterenchelys*, whereas in *Moringua* the heart is a considerable distance behind the gills and the palato-pterygoid is vestigial. In these and other characters the new genus is the more generalized; it is the type of a new family, which will be further characterized in a forthcoming paper on the classification of the Apodes.

*Heterenchelys microphthalmus*, sp. n.

Depth about 22 in the length. Tail nearly twice as long as rest of fish; head, to gill-opening, about  $\frac{1}{2}$  as long as distance from gill-opening to vent. Eye nearly equidistant from end of snout and angle of mouth; cleft of mouth a little more than  $\frac{1}{3}$  the length of head. Coloration uniform.

Two specimens, 390 and 460 mm. in total length, from the mouth of the Congo, presented to the British Museum in 1893 by Mr. V. H. Cornish.

*Heterenchelys macrurus*, sp. n.

Depth about 27 in the length. Tail more than three times as long as rest of fish; head, to gill-opening, nearly  $\frac{3}{4}$  of

distance from gill-opening to vent. Eye a little nearer to angle of mouth than to end of snout; cleft of mouth  $\frac{1}{3}$  the length of head or a little less. Coloration uniform.

Three specimens, 300 to 330 mm. in total length, from Lagos and Elobi.

XLIII.—*Notes on Malay Tigers, with Description of a new Form from Bali.* By ERNST SCHWARZ.

IN 1868\* Fitzinger described the tiger from Sumatra and Java as "*Der Sunda-Tiger*" (*Tigris sondaica*). As the Sumatra and Java tigers are subspecifically distinct, Fitzinger's name can only stand for one of these, and I propose to use it for the Javan race. In 1908 Pocock used Fitzinger's name for the Sumatran tiger, but he does not appear to have distinguished more than one race of Malay tiger, but simply followed Fitzinger.

In the diagnosis of *Tigris sondaica* Fitzinger describes the stripes as follows:—"fasciis angustis transversalibus parum numerosis." In a skin of a tiger from Java in the Senckenberg Museum, Frankfurt-a.-M., the stripes are narrow, as described by Fitzinger, whereas in a skin from Deli, Sumatra, in the same collection, and in the specimen described and figured by Pocock† (also Deli, Sumatra), they are "numerous, closely placed, and broad."

The tiger from Java will therefore have to stand as *Felis tigris sondaica* (Fitzinger).

The following races of Malay tiger can be distinguished:—

*Felis tigris*, subsp.

*Felis tigris*, var. *nigra*, Lesson, Nouv. Tabl. R. Anim., Mamm. p. 50 (1842) (Sumatra) (nom. nud.).

*Tigris sondaica*, Fitzinger (part.), Sitzungsab. k. Akad. Wiss. Wien, math.-nat. Cl. Bd. lviii. i. Abth. p. 454 (1868) (Java).

*Felis tigris sondaica*, Pocock (part.?), P. Z. S. 1908, ii. pp. 890-893, text-fig. 174 (1908).

*Hab.* Sumatra.

*Specimens examined.* 1 ♂ skull, 1 ♀ skin (mounted) with skull. Deli, Sumatra. Senckenberg Museum, Frankfurt-a.-M.

\* Sitzungsab. k. Akad. Wiss. Wien, math.-nat. Cl. Bd. lviii. i. Abth. p. 454 (1868).

† P. Z. S. 1908, ii. pp. 890-893, text-fig. 174 (1908).



Ground-colour somewhat paler than in *sondaica*; stripes rather broad, but less so than in *tigris*, and duplicated, especially on the hind-quarters and thighs. Shoulders rather scantily striped. Horizontal stripes on forehead distinct, broad. Back of ears black, with an elliptical white band below the tip and a number of brown hairs at base. Lower portion of face and anterior part of cheek-beard white. The light area above the eyes much larger than in *sondaica*, consisting of a white spot above the anterior angle of the eye and a buffy area above the eye, separated by a black band.

Fur longer and beard more distinct than in *sondaica*.

*Skull.* Somewhat smaller than in *F. t. sondaica*; zygomatic width markedly less. Occipital plane broad, its upper margin rounded; mastoid process conspicuously projecting laterally. Bullæ more rounded than in *sondaica*;  $P_4$  with better developed metacone and weaker protocone.

This local form of tiger appears to be intermediate between *F. t. sondaica* from Java and the mainland races. It is easily distinguished from *sondaica* by the broad nasals and the shape of the occipital plane.

*Felis tigris sondaica* (Fitzinger).

*Tigris sondaica*, Fitzinger (part.), Sitzungsber. k. Akad. Wiss. Wien, math.-nat. Cl. Bd. lviii. i. Abth. p. 454 (1868) (Sumatra).

*Hab.* Java.

*Specimens examined.* 1 skin, 3 ♂ skulls, 1 ♀ skull. Java. Senckenberg Museum, Frankfurt-a.-M.

Ground-colour light rusty; stripes very narrow, often duplicated. Less stripes in the shoulder region. Frontal stripes indistinct. Back of ears black except an elliptical white spot below the tip. Lower portion of cheeks white. A very small *whitish* area above the anterior angle of the eye.

Fur short and close.

*Skull.* Size rather larger. Nasals long and narrow. Occipital plane narrow, its upper margin triangular.

This is the largest of the island tigers. It is distinguished by the shape of the occipital plane.

*Felis tigris balica*, subsp. n.

*Type locality.* Bali.

*Type.* ♀ ad., skin and skull. Senckenberg Museum, Frankfurt-a.-M. No. 2576. Purchased from Dr. J. Elbert.

*Specimens examined.* One, the type.

Ground-colour somewhat brighter than in *sondaica* and light markings clearer white. Stripes a little broader and more duplicated. Frontal markings indistinct. Back of ears black except an elliptical white spot below the tip. Lower portion of cheeks white. A rather small *white* area above the anterior angle of the eye.

Fur short and close.

*Skull*. Very small; general plan as in *sondaica*. Nasals long and narrow. Occipital plane narrow, its upper margin triangular. Bullæ of the same general shape as in *sondaica*, but much flatter.  $P_4$  shorter.

*Dimensions* of type:—Head and body 1530 mm.; tail 580.

*Skull*: basilar length 207; condylo-basilar length 223; greatest breadth 169; mastoid breadth 100; nasals  $86 \times 41.5$ ; intertemporal constriction 44; width of brain-case 86; palatilar length 110; palate, greatest breadth (incl. teeth) 102; breadth of rostrum across roots of canines 71;  $p_4$  length on outer edge 30.6, breadth 15.5, greatest oblique diameter 31.5.

The Bali tiger is easily recognized by its very small size. In the shape of its skull it is much like *F. t. sondaica*, but differs in the flatness of the bullæ and the narrower zygomatic arches.

*Skull-measurements (in mm.) of Malay Tigers.*

Locality.	Age and sex.	Senckb. Mus. No.	Upper length.	Zygomatic breadth.	Nasals.	Breadth of Planum occipitale.
Deli, Sumatra ....	♂ ad.	2	309	206	$101 \times 50.3$	65
Sumatra .....	♀ ad.	1160	270	176	$94 \times 50$	51.5
Java .....	♂ ad.	1616	315	220	$103 \times 48.7$	52.8
Java .....	♀ ad.	4	290	195	$96 \times 47.7$	47.2
Bali .....	♀ ad.	2576	254	169	$86 \times 41.5$	41.5

XLIV. — *Descriptions of some new Burmese Species of Ruteline Coleoptera belonging to the Genus Anomala.* By GILBERT J. ARROW.

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ADDITIONAL forms of this great genus are continually found, and the larger the number of its species grows the less practicable becomes the task of subdividing it. About 700 have already been described, and yet from various tropical regions in which they abound hardly any have yet received names. Probably no country is more richly provided with species of this attractive group than Burma, but the number of described forms at present known from that country is insignificant. A few additions form the subject of this paper. They were collected chiefly by the late L. Fea, H. Doherty, and G. Q. Corbett, and a few by Mr. H. E. Andrewes. The types of all are in the British Museum, and co-types are either in Mr. H. E. Andrewes's collection or the Genoa Museum, or in both.

*Anomala* (subg. *Spinanomala*) *pallidospila*, sp. n.

Æneo-viridis vel cuprea, elytris testaceis, marginibus vel parte majora æneo-nigris, pronoti lateribus lineaque basali medio interrupta, scutello, elytrorum puncto submarginali post medium, femoribus, coxis sternoque partim, pallide flavis, pygidio obscure rufo, tibiis cupreis: elongato-ovata, paulo depressa, capite rugoso, clypeo semicirculari; prothorace crebre inæqualiter punctato, parce setoso, medio leviter sulcato, lateribus fortiter arcuatis, angulis anticis acutis, posticis fere rectis, basi anguste marginato, leviter trisinuato; scutello grosse punctato; elytris profunde striatis, interstitiis inæqualibus, subtiliter punctulatis; pygidio metasternoque leviter rugulosis et hirtiferis, abdomine crebrius ruguloso et flavido piloso, segmento 2° utrinque spinis tribus munito; pedibus posterioribus gracilibus, tibia antica fortiter bidentata, pedum 4 anticorum ungue majori fisso.

Deep metallic green or coppery green, the elytra light brown, with margins of varying breadth and sometimes nearly the whole greenish black, and the sides of the pronotum, a narrow basal line on each side, the scutellum, a small spot near the outer edge of each elytron behind the middle, and the greater part of the femora, coxæ, and sternum pale yellow. The pygidium is deep reddish and the tibiæ are coppery.

The shape is elongate ovate, rather depressed and distinctly tapering before and behind, and almost the whole

body, except the elytra, is clothed with rather coarse and not close greyish hairs. The head is rugose and the clypeus flat and semicircular. The pronotum is rather strongly punctured, the close and fine punctures being intermixed with larger ones, which bear long erect hairs. The scutellum bears a few large punctures and the elytra are deeply striated, the interstices being unequal and finely punctured. The pygidium and metasternum are rather lightly rugose and hairy, and the abdomen more closely. The second abdominal segment bears on each side three spines, rather larger than those forming the general clothing. The mesosternum is not produced, the front tibiæ are strongly bidentate, the four posterior legs very long and slender, and the larger claw of the front and middle feet cleft.

♂. The hind legs are longer than those of the female and the inner front claw is broad but very acute.

Long. 8-9 mm. ; lat. 4.5-5 mm.

*Hab.* BURMA: Maymyo, 3500 ft. (May 1910—*H. L. Andrewes*).

This species is said to feed on *Prunus persica*.

It is closely related to the group of Bornean species to which Dr. Ohaus has given the name *Spinanomala*. The characteristic spines at the sides of the abdomen differ only slightly from the general hairy clothing, and the mesosternal epimera are not produced upwards. It seems to me that no sufficient reason remains for regarding *Spinanomala* as more than a subgenus of *Anomala* in the present condition of the latter.

#### *Anomala bruchomorpha*, sp. n.

*Laete fulva*, capite (clypeo antice excepto), clava antennali, scutello, prothoracis vitta lata mediana nonnunquam, elytrorum fasciis duabus interruptis, pygidii maculis 2 basalibus bifidis, pectoris medio, tibiis posticis tarsisque omnibus nigris vel fuscis, corpore (elytris exceptis) æneo-micante: breviter ovata, supra paulo depressa, capite dense punctato, clypeo brevi, antice fere recto; pronoto crebre et æqualiter sat minute punctato, lateribus medio valde angulatis, dein antice fere rectis, postice paulo sinuatis, angulis anticis vix, posticis fere, acutis, basi haud marginato; scutello crebre punctato; elytris profunde sat æqualiter sulcatis, interstitiis minute et sparse punctulatis; pygidio subtiliter transverse strigoso; mesosterno haud producto, metasterni lateribus breviter griseo-pilosis; tibiis anticis bidentatis, pedum 4 anteriorum unguibus majoribus fissis.

Orange, suffused, except upon the elytra, with a greenish-metallic lustre and with black markings consisting of the



head (except the front part of the clypeus), a broad median stripe upon the pronotum (sometimes absent), the scutellum, and four irregularly shaped spots upon each elytron, forming two transverse median bands. A bifid mark upon each side of the base of the pygidium, the middle of the sternum, transverse bands on the dorsal side of the abdomen, the hind tibiae and all the tarsi are also usually dark, and the posterior part of the elytra from the second transverse row of spots is deeper in colour than the anterior part.

The body is shortly ovate and rather depressed above. The head is densely punctured, with the clypeus broad and nearly straight in front. The pronotum is minutely, densely, and evenly punctured, with the lateral margins strongly angulated in the middle, nearly straight to the front angles and gently incurved to the hind angles, all the angles being nearly right angles. The base is well lobed and without a marginal stria. The scutellum is closely punctured and the elytra are deeply and rather closely and regularly sulcate, the second sulcus broken into irregular punctures at the base and the interstices minutely and sparingly punctured, the fifth having a linear row of punctures either throughout its length or restricted to the basal part. The pygidium is finely transversely strigose. There is only a very short pubescence at the sides of the metasternum and the mesosternum is not produced. The front tibia is strongly bidentate and the longer claw of the front and middle feet is cleft. The club of the antenna is rather long.

♂. The club of the antenna is very long, and the teeth of the front tibia short and sharp.

♀. There is a slight dilatation of the outer margins of the elytra at the middle and the terminal tooth of the front tibia is long and blunt.

Length 10-12.5 mm.; breadth 6-7 mm.

*Hab.* BURMA: Toungoo (*G. Q. Corbett*), Karen Hills (*L. Fea*—2700-3300 ft.).

Both in shape and coloration this is a very well-marked and peculiar insect. I have examined several females, but only a single male, in which specimen alone the prothorax has a broad median dark band. It is not yet possible to decide whether this represents a sexual feature or merely a colour variety.

*Anomala bilobata*, sp. n.

Testacea, clypeo, tibiis posticis tarsisque omnibus rubris; corpus cylindricum, sat angustum, convexum, capite parvo, fortiter

punctato, clypei margine valde reflexo, antice bilobato; prothorace subtiliter punctato, lateribus arcuatis, angulis anticis fere rectis, posticis obtusis, basi marginato, leviter arcuato; scutello minute punctato; elytris minute punctatis, punctis plerisque seriatis, interstitio secundo lato, irregulariter punctato; pygidio rugose punctato; metasterno subtiliter rugose punctato, haud longe aut dense fulvo-piloso; pedibus omnibus setis raris rigidis munitis, pedis antici tibia tridentata, ungue majori fisso.

Testaceous, with the clypeus, hind tibiae, and all the tarsi reddish. The form is elongate and cylindrical. The head is small and deeply punctured, and the clypeus transverse, with the margin strongly reflexed and bilobed in front. The pronotum is very finely punctured, rounded at the sides, with the front angles nearly right angles, the hind angles very obtuse and the base finely margined and very gently rounded. The scutellum is finely punctured and the elytra bear irregular rows of fine punctures, the second interstice being wide and irregularly punctured. The pygidium is rather rugosely but not deeply punctured. The metasternum is finely and densely punctured and clothed with fine yellowish pubescence. The front tibia is tridentate and the inner claw of the front tarsus is cleft.

♂. The inner front claw is very broad. The clypeus is shining, a little excavated on each side and the lobes pointed.

♀. The clypeus is rugosely punctured, the lobes blunt, and the apex of the front tibia spatulate.

Long. 16–19 mm.; lat. max. 7·5–9·5 mm.

*Hab.* BENGAL: Calcutta, Murshidabad, Koolna (March—Ind. Mus.); BURMA: Tharrawaddy (*G. Q. Corbett*), N. Chin Hills, Bhamo, Teinzo (*L. Fea*—May & June, 1886): TENASSERIM: Tavoy (*Doherty*).

This insect, together with that which follows and *A. siamensis*, Nonfr., form a peculiar group distinguished by the bilobed clypeus and in the male by a form of œdeagus the paramera of which end in transverse laminae. *A. bilobata* is extremely like *A. siamensis*, of which Dr. Ohaus has kindly sent me for examination a typical male specimen, but it is a little more elongate and less stout. It is doubtful, however, if the absolute discrimination of the two is possible without examination of the genitalia, which are very different. They are shown in the accompanying sketches, the œdeagus of *A. bilobata* (fig. 1) being longitudinally grooved and the two terminal laminae meeting in a sharp angle behind. In that of *A. siamensis* (fig. 2), both groove

and angle are absent and the laminae are larger and of more irregular shape.

Fig. 1.



Fig. 2.



*Anomala fissilabris*, sp. n.

Testacea, tibiis tarsisque posticis nigris, clypeo et tarsis reliquis rufis; corpus sat angustum, cylindricum, parum convexum, capite parvo, fortiter punctato, clypei margine valde reflexo, bifido; prothorace cum scutello subtilissime punctato, hujus lateribus paulo fortius, marginibus lateralibus arcuatis, angulis anticis fere rectis, posticis obtusissimis, basi marginato, leviter arcuato; elytris minute punctatis, punctis plerisque seriatis, intervallo subsuturali lato, irregulariter punctato; pygidio modice punctato; metasterno subtiliter rugose punctato, fulvo piloso; pedis antici tibia tridentata, ungue majori fisso; pedis intermedii femore prope marginem inferiorem hirtis rigidis fulvis dense cristato,

Testaceous, with the hind tibiae and tarsi black and the remaining tarsi and the clypeus red.

The body is elongate and a little depressed. The head is small and strongly punctured, the clypeal margin strongly elevated and bilobed in front. The pronotum and scutellum are very minutely punctured, the former a little more strongly at the sides. The lateral margins are rounded, the front angles nearly right angles and the hind angles very obtuse. The elytra are very finely punctured, most of the punctures forming longitudinal rows, but with a wide irregularly punctured subsutural space. The pygidium is moderately punctured and the metasternum finely rugose and clothed rather thinly with yellowish hairs. The front tibia is tridentate, the larger front claw cleft, and the middle femur bears a thick fringe of stiff hairs just behind the posterior edge.

♂. The inner front claw is strongly dilated. The clypeus is a little excavated on each side and not densely punctured.

♀. The clypeus is densely punctured and the apical tooth of the front tibia long and blunt.

Long. 17-18 mm.; lat. 9 mm.

*Hab.* BURMA: Tharrawaddy, Promé (*G. Q. Corbett*), Minhla (*L. Fea*—May 1885).

This species is extremely close to *A. bilobata*, but differs in its rather finer puncturation, the black hind tibiae and tarsi, and the thick fringe on the middle femur.

*Anomala latipes*, sp. n.

Læte testacea, vertice, humeribus suturaque sat late nigris, linea suturali scutellum amplexante, prothorace nonnunquam bimaculato; corpore cylindrico, parum depresso aut lato, clypeo brevi, rugose punctato, margine antico fere recto, fronte crebre punctato; prothorace subtiliter æqualiter punctato, lateribus arcuatis, angulis anticis acutis, posticis obtusis; scutello punctato; elytris profunde punctato-striatis, marginibus membranaceis sat latis; pygidio æqualiter sat crebre punctato; corpore subtus parce piloso; tibiis anticis fortiter 3-dentatis, pedibus posticis brevibus, femoribus latis, trochanteribus longis, haud acutis, tibiis latis, postice haud constrictis; pedis antici ungue majori fisso.

Bright yellow, with the head behind the eyes, a spot on each shoulder, and a broad sutural line extending to the base black. A pair of black spots sometimes appears at the middle of the pronotum. The tarsi are reddish.

The body is rather cylindrical in shape, nearly parallel-sided, and not very depressed. The clypeus is rugose, short, and nearly straight in front and the forehead is closely punctured. The pronotum is finely and evenly punctured, with the sides rounded, the front angles acute, the hind angles very obtuse and the base finely margined and very feebly trisinate. The scutellum is punctured and the elytra are deeply punctate-striate. The pygidium is evenly and fairly closely punctured. The lower surface of the body is very thinly hairy. The front tibia is strongly tridentate and the hind legs are short, with the femur broad, the trochanter long and not acute, the tibia broad and not acute nor constricted before the extremity.

♂. The inner anterior claw is unequally divided and the trochanters of the hind legs are long, nearly parallel-sided, and rather prominent at the end.

♀. The black sutural line is broader than in the male, the forehead has a rugose area in front, the apex of the front tibia is spatulate, and the inner anterior claw almost equally divided.

Long. 14.5-16 mm.; lat. 7.5-8 mm.



*Hab.* BURMA: Thariawaddy (G. Q. Corbett), Cachin Hills.

*A. latipes* is very closely like *A. communis*, Burm., and *A. pallida*, F., but is narrower in shape, the black sutural line is broader, especially in the female, and the hind femora and tibiæ are shorter and broader.

*Anomala semiusta*, sp. n.

Pallide testacea, capite, pronoto (lateribus exceptis), scutelli lateribus, elytrorumque sutura (antice late) fusco-brunneis, capite pronotoque vix perspicue metallicis, clypeo, tibiis tarsisque rufis; pronoto nonnunquam medio plus minusve pallido: cylindrica, parum convexa, clypeo parvo, rugoso, antice fere recto, fronte ruge punctata; pronoto ubique sat æqualiter, haud fortiter punctato, basi marginato, lateribus cum angulis posticis regulariter arcuatis; scutello bene punctato; elytris fortiter punctato-striatis, interstitiis alternis latis atque irregulariter punctatis; pygidio cum metasterni lateribus crebre punctatis, parce pilosis; processu sternali nullo; tibia antica 3-dentata.

♂. Clava antennali modice elongata, oculis majoribus, tibiæ anticæ dentibus paulo acutis.

♀. Clypeo paulo latiori, tibiæ anticæ dente apicali clavato, tertio subobsoleto.

Pale testaceous, with the head, pronotum, except the lateral margins, the sides of the scutellum and the elytral suture brown, and the clypeus, tibiæ, and tarsi reddish. The head and pronotum have usually an exceedingly faint metallic lustre. The dark central mass of the pronotum is often divided into two by a pale median line.

Rather shortly cylindrical and parallel-sided, not very convex, with the clypeus small, nearly straight in front and finely rugose, and the forehead rugosely punctured. The pronotum is rather evenly but not strongly punctured all over, margined at the base, with the lateral margins and hind angles strongly and continuously rounded. The scutellum is well punctured and the elytra are deeply punctate-striate, with the humeral and alternate dorsal interstices very wide and irregularly punctured, the punctures of the fourth interstice becoming reduced upon the anterior half to a single row. The pygidium and metasternum are strongly and closely punctured and scantily hairy. There is no sternal process. The front tibia is 3-dentate and the inner claw of the front tarsus alone is cleft.

♂. The eyes are large, the clypeus very small, and the club of the antenna long. The three teeth of the front tibia are all well marked and rather sharp.

♀. The eyes are a little smaller, the clypeus rather larger, the terminal tooth of the front tibia blunt and clavate and the third tooth feeble.

Length 12–14 mm.; breadth 6·5–7·5 mm.

*Hab.* BURMA: Teinzo (*L. Fea*—May 1886).

This belongs, like the last species, to the *pallida* and *communis* group. It is more easily recognized than most of its allies by its marking and the almost obsolete hind angles of the thorax.

*Anomala erosa*, sp. n.

Testacea, capite toto, prothoracis disco, scutelli margine vel toto, elytrorumque marginibus internis et externis, vitta humerali striisque omnibus (nonnunquam dorso fere toto) nigris, pygidio et corpore subtus vel testaceis vel nigris vel variegatis, femoribus testaceis, tibiis et tarsis plus minusve infuscatiss: breviter ovata, convexa, nitida, capite densissime punctato, clypeo brevi, margine valde reflexo; pronoto subtiliter sat crebre punctato, postice marginato, lateribus fortiter arcuatis, angulis anticis paulo obtusis, posticis fere obsoletis; scutello minute punctato; elytris profunde punctato-striatis, interstitiis alternis latis, crebre irregulariter punctatis; pygidio crebre et subrugose punctato; corpore subtus minute punctato, parum hirsuto; processu meso-sternali nullo; tibiis anticis 3-dentatis, pedum 4 anteriorum ungue majori fisso.

Testaceous, with the entire head, the disc of the pronotum (sometimes divided by a pale median line), the circumference or the whole of the scutellum, the inner and outer borders of the elytra, a vitta extending backwards from the shoulder, and the grooves and punctures of the elytra black. The pygidium and underside of the body are either entirely pale or partly or entirely black, and the amount of dark pigmentation generally is extremely variable. The femora are usually pale and the tibiæ and tarsi more or less dark. The body is oval, short, convex, and smooth and shining. The head is densely and finely punctured, with the clypeus short and its front margin strongly reflexed. The pronotum is finely and rather closely punctured, with the sides strongly rounded, the front angles slightly obtuse and the hind angles rounded away. The base is finely margined. The scutellum is finely punctured. The elytra are very deeply striated, with the striæ closely punctured, the primary dorsal costæ very narrow and the intermediate intervals very broad, the lateral ones strongly punctured all over and the dorsal ones with deep crowded punctures along the middle, the latter reduced to a single row posteriorly upon the second sub-sutural interstice, and anteriorly upon the fourth interstice.

The pygidium is finely and subrugosely punctured and the lower surface is finely punctured and only very scantily hairy. There is no mesosternal process. The front tibia is tridentate and the longer claw of the front and middle feet cleft. The hind tibia is not strongly inflated or constricted.

♂. The inner front claw is very broad and divergently cleft, and the last abdominal segment is extremely short and only visible at the sides.

♀. The penultimate ventral segment is very broad and the last segment well developed.

Length 11·5–14·5 mm.; breadth 7–8·5 mm.

*Hab.* BURMA: Mandalay, Shenmaga (*L. Fea*—June 1885).

This is closely related to *A. varicolor*, Gyll., of which it has the general appearance and type of coloration, as well as great variability in the degree of pigmentation.

*Anomala dorsopicta*, sp. n.

Flava, vertice, pronoti vittis duabus, extus medio productis elytrisque nigris, his utrinque macula media ovata oblique ornatis, clypeo tarsisque rufis: elongato-ovata, sat lata, parum convexa; capite ubique sat fortiter punctato, clypeo brevi, margine valde reflexo; prothorace minute sat æqualiter punctato, lateribus arcuatis, basi marginato, trisinuato, angulis posticis rotundatis; scutello punctato; elytris profunde punctato-striatis, interstitiis angustis, convexis, lateribus post humeros paulo deplanatis; pygidio sat fortiter punctato; mesosterno haud producto; metasterno punctato et brevissime flavido-hirto; tibiis anticis bidentatis, pedum 4 posteriorum ungue majori bifido.

Bright testaceous yellow, with the head and tarsi reddish and the forehead (except a triangular excision in front), a longitudinal bar on each side of the pronotum, extending from front to hind margin and emitting an external branch at the middle, and the elytra, except an oblique oval patch a little before the middle of each, black. The head and prothorax have generally a very slight metallic lustre.

The shape is elongate-oval, moderately broad and not very convex. The head is strongly and rather evenly punctured, with the clypeus short, rounded at the sides and strongly reflexed at the edge. The pronotum is rather finely but regularly punctured, strongly rounded at the sides, margined and trisinuate at the base, with the hind angles very obtuse. The scutellum is punctured and the elytra are deeply punctate-striate, with the interstices narrow and convex and the outer edge flattened for a short distance behind

the shoulder. The pygidium is evenly punctured and the sides of the metasternum rugosely punctured and very thinly clothed with short hair. The front tibiæ are strongly bidentate and the larger claw of the front and middle feet cleft.

♂. The forehead and clypeus are shining and the inner lobe of the cleft front claw is broad.

♀. The forehead and clypeus are more densely punctured and scarcely shining, and the dilated margins of the elytra are thickened.

Long. 13-14 mm.; lat. 7-8 mm.

*Hab.* BURMA: Tharrawaddy, Toungoo, Promé (G. Q. Corbett).

*Anomala auripennis*, sp. n.

Testacea, viridi-vel roseo-aurata, capite, pronoto (marginibus lateralibus exceptis), tibiis posticis tarsisque omnibus viridicupreis: ovata, vel elongato-ovata, convexa, parum nitida; capite omnino dense punctato, clypeo rugoso, sat lato; pronoto etiam dense punctato, basi haud marginato, lateribus medio obtuse angulatis, angulis anticis fere rectis, posticis distinctis sed paulo obtusis; scutello sat fortiter punctato, lateribus lævi; elytris minute punctatis, punctis majoribus intermixtis, his costas suturalem, intrahumeralem et intermediam plus minusve distinctas indicantibus, interstitio subsuturali latissimo et confuse punctulato; pygidio subtiliter transverse strigato; pectore sat dense flavido-pubescenti, mesosterno haud producto, tibiis anticis bidentatis; tarsorum 4 anteriorum ungue majori fisso, antennis paulo longis, articulo 5° ad duos præcedentes æquali.

Pale yellow, entirely suffused with a rosy or greenish-golden tinge, the head, pronotum (except the pale lateral margins), hind tibiæ and all the tarsi deep coppery green.

It is ovate, short, or moderately long, convex and only slightly shining. The head and pronotum are very closely punctured all over, the clypeus rugose and broadly rounded. The prothorax is not margined at the base and the sides are scarcely rounded, but slightly angulated before the middle, with the front angles almost right angles and the hind ones well marked but obtuse. The scutellum is well punctured except at the sides. The elytra are minutely punctured all over, with larger punctures between. The latter form a sutural and two paired dorsal rows, the subsutural interstice being very broad and coarsely punctured. The pygidium is finely transversely strigose. The sternum is moderately thickly clothed with soft yellowish pubescence. There is no mesosternal process. The front tibia is bidentate and the



larger claw of the front and middle tarsi cleft. The antennæ are rather long and the fifth joint equal in length to the two preceding joints together.

♂. The club is as long as the remainder of the antenna and the front tibial teeth are very short.

♀. The body is more elongate, the antennal club moderately long, and the terminal tooth of the front tibia long and clavate.

This rather resembles the Japanese *A. lucens*, Ball., and some varieties of the European *A. ænea*, Deg., but it is sharply distinguished from these, as from nearly all species of the genus, by the length of the fifth joint of the antenna.

Length 13–18 mm.; breadth 8–9.5 mm.

*Hab.* BURMA: Rúby Mines (*Doherty*), Karen Ghecu (*L. Fea*, 3900–4200 ft.—Feb., Mar. 1888); TENASSERIM: Plapoo (*L. Fea*—Apr. 1887), Mooleyit (3000–3900 ft.—Apr. 1887).

### *Anomala aurora*, sp. n.

Læte testacea, toto roseo-metallico-suffusa, pronoti et pygidii lateribus femoribusque posticis nonnunquam brunneo-punctatis: breviter ovalis, convexa; capite rugoso-punctato, clypeo semicirculari, plano, margine reflexo; pronoto minute haud dense punctato, lateribus medio obtuse angulatis, angulis anticis acutis, posticis distinctis sed obtusis, basi marginato, leviter trisinuato; scutello minute punctato; elytris fortiter et æqualiter seriato-punctatis, spatio subsuturali lato, irregulariter punctato; pygidio corporeque subtus fortiter haud dense punctatis, hoc sparse pallido-hirto; mesosterno haud producto; tibia antica fortiter bidentata, femore postico brevi, crasso, tibiaque antice paulo inflata; tarsorum 4 anteriorum ungue majori fisso.

Pale yellow, entirely suffused above and beneath with a delicate rosy-green metallic lustre, sometimes with a large vaguely reddish patch on each side of the pronotum, a small brown spot near each lateral margin and two or three still smaller on each side of the pygidium.

It is a stout, oval, and highly convex species. The head is rugosely punctured, with the clypeus semicircular and flat. The pronotum is minutely and sparingly but rather deeply punctured, with its sides obtusely angulated in the middle, the front angles acute, the hind angles obtuse but well-marked, and the base margined and gently trisinuated. The scutellum is minutely punctured and the elytra strongly in regular rows, with a wide, irregularly punctured second

interstice. The pygidium and the lower surface are rather strongly but not closely punctured, the latter thinly clothed with pale hairs. The front tibiæ are strongly bidentate, the hind femora short and thick, the hind tibiæ a little inflated in the basal half, and the larger claw of the front and middle feet cleft.

The sexes scarcely differ, but the inner anterior claw of the male is a little widened and the apex of the front tibia rather less blunt.

Long. 10.5–12 mm.; lat. 5.5–6.5 mm.

*Hab.* BURMA: Maymyo (*H. L. Andrewes*—May 1910), Ruby Mines (*Doherty*).

Mr. H. M. Lefroy has received the species from Maymyo as feeding upon *Prunus persica*.

*Anomala puella*, sp. n.

Tota pallide flava, leviter metallescens, tarsi antennisque paulo rufescentibus: breviter ovata, nitida, convexa, pygidio corporeque subtus pilis erectis pallidis vestitis; capite profunde rugoso-punctato, clypeo late rotundato, margine valde reflexo, sutura clypeali distincte carinata: pronoto sat crebre æqualiter punctato, lateribus fortiter arcuatis, angulis anticis acutis, posticis fere obsoletis, basi omnino marginato; scutello punctato; elytris profunde punctato-striatis, interstitio subsuturali lato, grosse punctato, aliis angustis, parce et minutissime punctulatis; pygidio crebre irregulariter punctato; prosterno postico paulo tuberculato, mesosterno haud producto; tibiis anticis bidentatis pedumque 4 anteriorum ungue majori fisso.

Entirely pale yellow, with a faint metallic lustre, the antennæ and tarsi only being a little darker. The body is shortly ovate in form, convex and shining, with pale erect hairs upon the pygidium and lower surface. The head is strongly and rugosely punctured, with the clypeus short and broadly rounded, its margins strongly reflexed and the frontal suture carinate. The pronotum is strongly and closely punctured, with the base completely margined, the sides strongly rounded, the front angles acute and the hind angles rounded away. The scutellum is well punctured and the elytra are closely striate-punctate, with the interstices narrow, except the subsutural one which is broad and strongly and irregularly punctured. The pygidium is strongly and closely punctured. The prosternum is slightly lobed behind the front coxæ and the mesosternum is not produced. The front tibiæ are bluntly bidentate and the larger claw on each of the four anterior feet is cleft.

♂. The lower lobe of the inner front claw is acutely pointed, broad, and angulated at the lower edge.

Length 10 mm. ; breadth 5.5–6.5 mm.

*Hab.* BURMA: Karen Hills (*Doherty*).

This little insect is one of the puzzling species which stand on the border-line between *Anomala* and *Mimela*. It is very much like *Mimela debilis*, Sharp, to which it is undoubtedly allied. The prosternum is prominent behind the front coxæ, but does not form an angular process between them, and the species must, I think, be placed in *Anomala* if any distinction is to be retained.

*Anomala (Euchlora) laniventris*, sp. n.

Obscure cupreo-olivacea, pronoti lateribus, corpore subtus femoribusque testaceis, tibiis tarsisque viridi-æneis, abdomine subtus brunnescenti: ovalis, supra parum nitida, pectore, abdominis lateribus pygidioque sat dense griseo-pubescentibus, corpore supra undique crebre sat minute punctato, elytrorum lineis nonnullis inconspicuis longitudinalibus, marginibus externis latissime membranaceis; mesosterno haud producto; tibiis anticis bidentatis, pedum 4 anteriorum ungue majori fisso.

Dark coppery olivaceous, with the lateral edges of the pronotum, the lower surface of the body and the femora yellow, the abdomen browner and the tibiæ and tarsi deep metallic green.

Elongate oval, not very shining, with the sternum, the pygidium and sides of the abdomen rather thickly clothed with soft grey pubescence. The entire upper surface is closely and finely punctured, except the clypeus, which is rugose and broadly rounded. The base of the pronotum is rather prominent in the middle and not margined, and the sides are obtusely prominent in the middle, with the front angles nearly right angles and the hind angles obtusely rounded. There are a few indistinct longitudinal rows of fine punctures on the elytra, the outer margins of which are bordered with very broad membranous fringes. There is no mesosternal process. The front tibia is sharply bidentate and the larger claw of the front and middle feet is cleft. The third and fifth joints of the antenna are longer than the fourth.

♂. The terminal tooth of the front tibia is slender and the upper one short but sharp. The inner lobe of the inner front claw is very broad and abruptly angulated at the middle of the lower edge.

♀. The teeth of the front tibia are rather long and sharp.

Length 17–19 mm. ; breadth 9·5–10·5 mm.

*Hab.* BURMA: Paungde (*G. Q. Corbett*) ; Palon, Pegu (*L. Fea*—Aug. & Sept. 1887) ; Rangoon (*E. T. Atkinson*).

This species is related to the Himalayan *A. perplexa*, Hope, but much duller in colour and easily recognizable by the very broad external membranes of the elytra.

*Anomala (Euchlora) chlorochelys*, sp. n.

Læte viridis, nitida, corpore subtus, pedibus, capitis, prothoracis et elytrorum marginibusque extremis aureo-rufis: grandis, ovalis, convexa; clypeo crebre punctato, fronte minus crebre aut grosse, pronoto subtilissime sat dense, elytris similiter sed minus denso punctatis, his valde nitidis, lateribus postice paulo dilatatis, apice fere recte truncato, marginibus membranaceis obtectis; pygidio minute haud profunde striguloso.

Bright green, with the lower surface, legs, and extreme edges of the head, pronotum, and elytra golden red.

It is a large, very shining, oval and convex species, with the outer margins of the elytra conspicuously dilated behind the middle and truncate at the apex. The clypeus is rounded and closely punctured, the forehead more finely and less closely. The pronotum is very finely and closely punctured, a little more strongly at the sides. The elytra are very shining, finely and lightly punctured, with the outer margins conspicuously dilated towards the extremity and truncate behind, forming an obtuse external angle. The membranous margins are narrow and almost concealed by the lateral dilatation. The pygidium is submetallic and transversely rugulose. The front tibiæ are bidentate and the larger claw of the front and middle feet cleft.

♂. The two teeth of the front tibia are sharp and close together.

♀. The two teeth of the front tibia are less sharp and close together, and the pygidium bears a few long scattered hairs.

Long. 26–29 mm. ; lat. max. 15–16·5 mm.

*Hab.* BURMA: Bhamo (*Selkirk, Fea*—June 1885) ; Teinzo (*Fea*—May 1886) ; TENASSERIM (*Col. Adamson*).

The species resembles *A. truncata*, Bates, but is larger and much more smooth and shining.



## XLV.—On the Stromatoporoids and Eozoon.

By R. KIRKPATRICK.

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[Plates VIII. &amp; IX.]

IN a letter to 'Nature,' Aug. 15, 1912, p. 502, I wrote that the presence of siliceous spicules in the Stromatoporoids, similar to those found in *Merlia* and *Monticulipora*, had led me to the conclusion that Stromatoporoids were Sponges. I must now state that I was misled to that conclusion, for it has become evident to me that the supposed spicules are the calcified chitinous rings and half-rings belonging to the canals and chambers of Foraminifera. It is now clearly obvious also that the calcareous skeleton of Stromatoporoids has a structure similar to that of the higher forms of Perforate Foraminifera.

It is not surprising that palæontologists have failed to arrive at a correct solution of the problem of the Monticuliporas, for these organisms, when alive, exhibit extraordinary phenomena without parallel elsewhere in biology, and wholly impossible to understand without observing living specimens. Most fortunately the discovery of the living *Monticulipora* (*Merlia*) *normani* off Porto Santo Island will enable me to explain the real nature of the Palæozoic examples.

The Stromatoporoids, on the other hand, carry in themselves the clue to the problem they present, and it is at first sight a little surprising that this clue has eluded the patient search of so many investigators. This result was, I believe, due to the use of insufficiently high magnifying-powers.

Stromatoporoids are commonly in the form of hemispherical or cake-like masses, but they may be incrusting or digitate.

The surface has a roughly granular aspect and presents scattered stellate patterns (astrorhizæ). A vertical section (or weathering of the edges) shows that the mass is built up of concentric laminæ or crusts.

Slight magnification of a vertical section shows apparently a meshwork of regular or irregular radial and concentric calcareous strands, these being really the edges of walls of Foraminiferal chambers.

The so-called "tabulæ" are present in the usually darker calcified soft tissues filling the meshes or spaces not only in *Stromatopora*, but also in *Actinostroma*. Stromatoporoids are found in the Ordovician, Silurian, and Devonian strata.

From Nicholson's great monograph on the British Stromatoporoids I extract a few historical data.

The history of the group practically begins with Goldfuss (1826), who described a fossil (probably from the Devonian of Gerolstein), which he named *Stromatopora concentrica* and placed near *Millepora*.

In the following list I give the name of the author, the date, and his views as to the nature of Stromatoporoids:—

GOLDFUSS, 1826. Hydrocorallinæ.

STEININGER, 1834. Sponges.

F. RÖMER, 1843-4. Corals.

HALL, 1847. Alcyonarians near *Tubipora*.

D'ORBIGNY, 1850-51. Sponges.

The two SANDBERGERS, 1850-56. Polyzoa.

F. RÖMER, 1851-56. Polyzoa, but later tabulate corals like *Favosites* and *Chætetes*.

BILLINGS, 1857. *Beatricea* (a Stromatoporoid), a vegetable.

EICHWALD, 1860. Horny sponges.

HYATT, 1865. Some Stromatoporoids regarded as Cephalopoda.

BARON VON ROSEN, 1867. Horny sponges.

Dr. G. LINDSTRÖM, 1870. Foraminifera, and, in 1873, *Labechia* allied to Hydractinia.

SALTER, 1873. Calcareous sponges.

NICHOLSON, 1873-4. Calcisponges.

DAWSON, 1875. Between Foraminifera and Sponges.

SOLLAS, 1877. Hexactinellid sponges, and, later, partly siliceous sponges, partly Hydrozoa.

CARTER, 1877. Hydrozoa.

NICHOLSON, 1886 (the Monograph). Partly Hydroida, partly Hydrocorallinæ.

ZITTEL, 1903. Hydrozoa.

GEIKIE, 1903. Polyzoa.

STEINMANN, 1907. Hydrozoa.

KIRKPATRICK, August 1912: Sponges. September 1912: Foraminifera.

To sum up, within the last eighty-six years Stromatoporoids have been regarded as Foraminifera; calcareous, horny, Monaxonellid, and Hexactinellid Sponges; Hydroida, Hydrocorallinæ, *Alcyonaria*, corals (Anthozoa), Polyzoa, Cephalopoda, vegetables.

Kepler wrote a treatise, which is said to be highly instructive, entitled 'A Book of Mistakes.' A few observations on some of the errors recorded in the above list will not be without interest.

The "Cœlenterate" view was mainly held on account of the presence of "tabulæ," the Sponge theory owing to the oscule-like astrorhizæ, to the incrusting and enveloping character of some species, and to the resemblance of the skeletal

framework to that of a Dictyonine sponge. *Beatricea* was compared to an *Orthoceras*-like mollusc.

I myself at first mistook altered chitinous rings and coils for siliceous spicules, the astrorhizæ for oscules, and the tabulæ for diaphragms and dissepiments like those of *Cliona*, and regarded the general skeletal framework as an originally spicular structure altered by mineralization, for I could often see rings and apparent sigmas imbedded in it. I found later, however, that the supposed "spicules" were altered chitinous hoops and spirals. The astrorhizæ appear to be due to the fusion of several outer openings of tubuli, thereby leading to the converging of finer pseudopods into main trunks. Pl. IX. figs. 13, 14, representing a longitudinal vertical section of *Polytrema cylindricum*, shows, for instance, tubuli with a relatively large single external opening and one, two, or three smaller inner openings, a compound system being funnel-shaped with a cribriform mouth directed inwards. A growth and extension of this simple system would result in the formation of an astrorhiza. Further, a more careful examination revealed the typical Foraminiferal structure of the skeleton itself.

What chiefly led me to regard the Stromatoporoids as siliceous sponges was the discovery, in the sections of those fossils, of little "pockets" of coiled sigma-like bodies and also tubular canals lined with these bodies in scalariform fashion. I had seen a somewhat similar arrangement of ring-like real siliceous spicules in the sponge part of "*Merlia normani*," which at one stage of my devious gropings after the clue to this mystery I had named *Noronha scalariformis*. But presently I found similarly shaped rings in the soft tissues of decalcified recent Foraminifera\*. Here the chitin has resisted the acid used for decalcifying, and the rings seemed to be chitinous, but in the fossils they looked like siliceous spicules. I now examined the skeletal framework, and saw that it was penetrated by tubuli and channels of communication between chambers.

The so-called tabulæ, which were supposed by Nicholson to be similar to those of *Millepora*, are diaphragms formed in the chambers and in the course of the canals.

These "tabulæ" are present in the spaces filled by the soft tissues, both in the *Stromatopora* type and in the *Actinostroma*

\* Evidently the function of the chitinous hoops and coils is to give support to the soft monilated branching sarcodæ. The swellings on many of them are due apparently to lateral compression arising from the pull of the extensile sarcodæ along an axis at right angles to the plane of the hoops.

type of Stromatoporoids. Apparently Nicholson failed to see them in the latter, supposing the holes in the regular "tangential laminae" to represent the "zooidal tubes."

Nicholson's classification, based on the erroneous idea that one group of Stromatoporoids (the Actinostromida) was related to *Hydractinia*, and the other (Stromatoporidæ) to *Millepora*, needs revision. As Nicholson himself pointed out, there are transitions between Actinostromids and Stromatoporoids. In both there are concentric layers, astrorhizæ, "tabulæ," and a capacity for incrusting and enveloping other objects, such as corals. In the Actinostromid or rectilinear type the calcareous skeleton has a more regular and definite arrangement of chambers than has the Stromatoporid type.

My intention in the present paper, however, is not to enter into the question of the classification of Stromatoporoids, but mainly to announce that these fossils have a calcareous skeleton showing the Foraminiferal structure.

While I was examining sections of the aberrant genus *Beatricea* I was reminded of the peculiar structure of *Eozoon*, and was thereby led to examine specimens of the latter, despite the fact that current opinion is almost wholly opposed to a belief in their organic nature. Zittel\*, following Prof. Karl Möbius†, refers to *Eozoon* as a product of purely mineral origin. Steinmann‡ does not even mention this, perhaps the most interesting of all fossils, but writes, "Aus der eozooischen Periode kennen wir kaum sichere Spuren organischer Wesen." Likewise in Lister's§ memoir on the Foraminifera there is no reference to *Eozoon*. Hartog|| writes in a footnote: "The alleged Archæan genus *Eozoon*, founded by Carpenter and Dawson on structures found in the Lower Laurentian serpentines and referred to the close proximity of Nummulites, has been claimed as of purely mineral structure by the petrologists; and recently biologists have admitted the claim." Geikie¶, while stating the pros

\* Zittel, K., 'Grundzüge der Paläontologie,' Abth. i. 2nd edition, 1903, p. 35.

† Möbius, K., 'Palæontographica,' xxv. 1878, p. 175. Also Carpenter, on Möbius's results, 'Nature,' vol. xx. 1880, p. 272.

‡ Steinmann, G., 'Einführung in der Paläontologie,' ed. 2, 1907, p. 7.

§ Lister, J. J., 'Treatise of Zoology' (ed. by E. R. Lankester), Memoir "Foraminifera."

|| Hartog, M., 'Cambridge Natural History' (Harmer and Shipley), Memoir "Protozoa," 1906, p. 70.

¶ Geikie, A., 'Text-book of Geology,' 1903, p. 878. See also Sherborn, 'Bibliography of the Foraminifera,' under Dawson, Möbius, Carpenter, &c.



and cons of the opposing views, apparently inclines to a belief in the mineral theory, and demands, in view of the antiquity of the rocks and the changes to which they have been subjected, the clearest possible evidence of organic structure before accepting the theory of the organic nature of *Eozoon*.

I consider that the sections made by the late Dr. Carpenter yield abundant evidence of organic structure.

*Eozoon canadense* is a Foraminiferan. Its calcareous skeleton shows clearly the Foraminiferal structure of pores and tubuli, and, further, chitinous rings and coils are present.

Dr. Carpenter's specimens must have died peacefully on the Lower Laurentian sea-bottom, and have been buried and slowly metamorphosed by infiltration, but in such a way as to preserve a good deal of their structure. Possibly igneous eruptions may have occurred later within varying distances of the dead specimens, leading to varying degrees of mineralization. I suppose the theory of the mineral origin of *Eozoon* is due to the existence of much metamorphosed specimens.

Fortunately Dr. Carpenter had several very fine examples of *Eozoon* in his magnificent collection (now in the British Museum, Nat. Hist.). About the time of his death he was engaged in writing a monograph which would have finally settled the whole question. A friend of mine who knew him tells me that Dr. Carpenter could scarcely listen with patience to the arguments of the mineralists, and I can appreciate this attitude when I look at his beautiful sections. Sir William Dawson, too, had occasion to resent the charge of "subjectivism" brought against him by an upholder of the mineral theory.

Sir W. Logan\* was the first to notice the resemblance of *Eozoon* to the Stromatoporoids.

The recent Foraminiferan *Polytrema cylindricum*, Carter, recalls in certain respects both *Beatricea* and *Eozoon*. This pretty little branching Foraminiferan, of a brilliant yellow or red colour, has a surface-layer of large chambers, but at the same time the central axis of the branches is occupied with a smaller vesicular tissue. A transverse section of *Beatricea* has somewhat the appearance of that of a megalospheric Foraminiferan.

In the Stromatoporoids and *Eozoon* there is a many-chambered (Polythalamous) calcareous skeleton with the walls of the chambers penetrated by fine tubuli. Altered chitinous hoops and coils are found in the communication-

\* Logan, W., 'Geology of Canada,' 1863, p. 49.

channels between chambers and in the chambers themselves, *i. e.* in the spaces formerly filled with sarcode. Similar structure to the above is found in the recent Perforate Foraminifera. Weathered edges of specimens of *Eozoon* are finely laminate.

With regard to *Eozoon*, two objections are urged against the organic theory, viz. the immense antiquity of the Lower Laurentian limestones and the unlikelihood that any organic structure could survive the effect of metamorphosing agencies. Concerning the first objection, it may be said that when once an organism is entombed and infiltrated the time factor *per se* is not an important one. Many Devonian Stromatoporoids are less well preserved than those of Silurian age, and a Foraminiferan might retain its structure as well in a Laurentian as in a Wenlock limestone. The effect of igneous action on the fossils of any particular formation is apparently more or less a matter of chance, and examples of late origin may fare worse than those of earlier date.

Leaving hypotheses and coming to facts—to wit, the specimens themselves,—I find that the Foraminiferal theory is wholly adequate, and I am certain it is unnecessary to go further afield in search of some highly complicated and problematical theory of mineral origin. As a matter of course, the evidence for the mineral theory, based mainly on the existence in *Eozoon* of minerals of igneous origin, falls to the ground in presence of the least trace of indubitable organic structure.

*Summary.*—The Stromatoporoids are Foraminifera.

*Eozoon canadense* likewise belongs to the Foraminifera, and is nearly related to *Labechia* and *Beatricea*.

#### *Note on Caunopora.*

Many of the *Caunopora* tubes so frequently found in Stromatoporoids are not corals, but Chaetopod worms, apparently belonging to the group Spioniformia.

It is sometimes possible to see anatomical features, such as the introvert, pharynx, intestine, peristomial cirri, and acicula. The supposed “tabulæ,” which have misled some investigators, are simply the expression of Annelidan segmentation or, rather, annulation.

I have found what appears to be a similar kind of worm in the living *Monticulipora* (*Merlia*) *normani*, and at Porto Santo Island have often watched it extending and drawing in its peristomial cirri or “tentacles.” The Palæozoic Monticuliporas are frequently infested with a worm possibly related to this modern one. If this is so, we have a curious instance of the conservatism of Nature.

EXPLANATION OF THE PLATES.

PLATE VIII.

- Fig. 1. *Stromatopora concentrica*, Goldfuss, from Devonian of Gerolstein. Wall of a chamber, showing tubuli.  $\times 325$ .  
 Fig. 2. Larger tubuli from an older wall.  $\times 550$ .  
 Fig. 3. Hoops and coils in chambers and canals of *S. concentrica*. 3 a. Ditto from *Actinostroma clathratum*, Nich. Both  $\times 1300$ .  
 Fig. 4. Ditto from sarcode of *Polytrema cylindricum*, Carter.  $\times 1300$ .  
 Fig. 5. Part of wall of chamber of *Eozoon canadense*, Dawson, from Lower Laurentian limestones, Burgess, Canada, showing mural pores and tubuli.  $\times 140$ .  
 Fig. 6. The same.  $\times 550$ .  
 Fig. 7. Old branching canals in *Eozoon*.  $\times 1300$ .  
 Fig. 8. Branching system of canals in *Eozoon*.  $\times 35$ . 8 a. The same showing hoops.  $\times 325$ .  
 Fig. 9. Hoops and coils in chambers and canals of *Eozoon*.  $\times 1300$ .  
 Fig. 10. The same from another specimen.  $\times 1300$ .

PLATE IX.

- Fig. 11. Canals in *Eozoon*.  $\times 140$ .  
 Fig. 12. *Eozoon*. Young chambers forming just below surface of specimen. a, mural tubuli; b, diaphragm across opening in chamber.  $\times 140$ .  
 Fig. 12 A. Series of young chambers.  $\times 50$ .  
 Fig. 12 B \*. Minute Foraminiferan found in one of the chambers of *Eozoon*.  $\times 190$ .  
 Fig. 13. Vertical longitudinal section of *Polytrema cylindricum*, Carter.  $\times 12$ .  
 Fig. 14. Wall of chamber of same, showing branching tubuli.  $\times 100$ .  
 Fig. 15. *Caunopora* tube in *Stromatopora bücheliensis*, Bargatzky, Devonian, showing Spioniform worm inside. a, acicula.  $\times 35$ .  
 Fig. 16. Another *Caunopora* tube from same section, showing surface annulations of annelid inside.  $\times 17$ .

XLVI.—*The Anatomy and Classification of the Teleostean Fishes of the Order Lyomeri.* By C. TATE REGAN, M.A.

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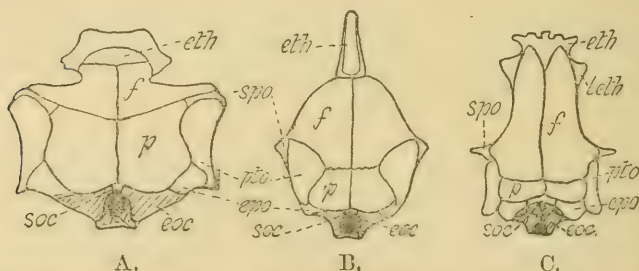
Order LYOMERI.

Scaleless soft-rayed fishes with a long slender tail, dorsal and anal fins long, no caudal, pectorals (when present) small and pelvies absent. Gill-openings small, separate. Mouth

\* The discovery of the beautiful little coiled shell (fig. 12 B) in one of the chambers of *Eozoon canadense* settles the "*Eozoon* controversy" beyond the possibility of further dispute. I do not think that the shell is a young stage of *Eozoon*, but rather that it has been ingested as food from without.

very large and pharynx very distensible; upper border of mouth formed by a single pair of slender bones (præmaxillo-maxillaries) meeting anteriorly and with their distal extremities attached within the quadrates, connected by a loose membrane anteriorly with a movable ethmoidal rostrum and for the greater part of their length with the suspensorium; lower jaw of dentary, articulare, and angulare; mandibular rami slender, loosely united at the symphysis and connected by a broad distensible membrane; suspensorium long and directed obliquely backwards, of two bones, hyomandibular and quadrate, which are movably articulated; opercular bones absent and branchiostegals vestigial; branchial arches and pectoral arch far behind the head, with skeleton reduced and little ossified. Skull with much cartilage, the membrane bones very thin; parietals meeting in front of the small supraoccipital; no exoccipital condyles. Vertebral centra co-ossified with arches, which are reduced, the neural arches appearing as paired, erect, spine-like processes; no ribs. No air-bladder. Gonoducts normally developed (*fide* Zugmayer).

The whole structure of the Lyomeri is quite unlike that of the Apodes; in my opinion they may well have been derived from Iniomi such as the Synodontidæ, which approach them in the short snout, wide mouth, oblique suspensorium, &c. (*cf.* Ann. & Mag. Nat. Hist. (8) vii. 1911, p. 124).



Diagrams of upper surface of skull in A. *Gastrostomus bairdii*, B. *Succopharynx ampullaceus*, and C. *Saurida nebulosa*. (A after Zugmayer's figure, modified by omission of sutures that appear to subdivide the frontals.)

*eth*, mesethmoid; *leth*, lateral ethmoid; *f*, frontal; *p*, parietal; *spo*, sphenotic; *pto*, pterotic; *epo*, epiotic; *soc*, supraoccipital; *eoc*, exoccipital.

The skull of the Synodontidæ has much in common with that of the Lyomeri, and the greater width of the pterotics and greater size of the whole postorbital portion of the



skull in the latter is for the attachment of the enlarged suspensorium, and is consequently more marked in *Gastrostomus* than in *Saccopharynx*.

The vertebræ of the Synodontidæ are also very similar to those of the Lyomeri; inferiorly there are short processes at the end of each centrum, exactly as shown in Zugmayer's figure of the anterior vertebræ of *Gastrostomus*; the neural arches are slender processes, and in the vertebræ below the dorsal fin these are shortened and do not meet to form unpaired neural spines.

It is of interest to note that in the Apodes the pectoral arch is pushed backwards by the large branchial apparatus, but in the Lyomeri the pectoral arch and the reduced branchial apparatus are displaced by the enormous pharynx, the distensibility of which is increased by the pendent movable ethmoid and the joint between the hyomandibular and the quadrate.

The order Lyomeri was first characterized by Gill and Ryder (Proc. U.S. Nat. Mus. vi. 1883, p. 262), who gave an account of the anatomy of *Gastrostomus bairdii* and maintained the distinctness of these fishes from the Apodes. Quite recently the anatomy of *Gastrostomus* has again been described by Zugmayer (Rés. Camp. Sci. Monaco, xxxv. 1911, p. 88, pl. iv.).

After comparison of the upper surface of the skull of *Saccopharynx* with Gill and Ryder's description and Zugmayer's figure of *Gastrostomus* I agree with the former authors that the Saccopharyngidæ and Eurypharyngidæ may be regarded as distinct families.

#### Family 1. Saccopharyngidæ.

Mouth large; jaws with slender, curved, pointed teeth; stomach very distensible; gill-openings much nearer to end of snout than to vent; skull longer than broad; frontals larger than the parietals. Piscivorous.

A single species, *Saccopharynx ampullaceus*, Harwood, 1827.

#### Family 2. Eurypharyngidæ.

Mouth enormous; jaws with minute teeth, the mandibles sometimes with a pair of symphysial canines; stomach not specially distensible; gill-openings much nearer to vent than to end of snout; skull not longer than broad; parietals larger than frontals. Probably feeding mainly on small invertebrates.

*Eurypharynx*, Vaill. 1882 (with symphysial mandibular canines); *Gastrostomus*, Gill and Ryder, 1883; *Macropharynx*, Brauer, 1902 (without pectoral fins).

XLVII.—*A Revision of the Asilidæ of Australasia.*

By GERTRUDE RICARDO.

[Continued from p. 160.]

## DASYPOGON, Macquart.

Illiger's Magazine f. Ins. ii. p. 70 (1803).

The species from Australia and Tasmania not yet assigned to other genera from *Dasypogon* in *sensu lato* are the following :—

*Dasypogon australis*, Macq., Dipt. Exot. i. (2) p. 45 (1838).

*Dasypogon albonotatus*, Macq., l. c. Suppl. ii. p. 49 (1846).

*Dasypogon nigripennis*, Macq., l. c. Suppl. iii. p. 180, pl. i. fig. 10 (1847).

*Dasypogon nigrinus*, Macq., l. c. Suppl. iv. p. 66, pl. vi. fig. 9 (1849).

*Dasypogon carbo*, Walker, Dipt. Saund. i. p. 87 (1851).

The type of this last is probably destroyed, not being in the Brit. Mus. Coll.

*Dasypogon australis*, Macq.

Type a female seen by me in the Paris Museum, 12. 4. 11.

The head is gone, and Macquart makes no mention of it in his description ; it is therefore impossible to assign it to any genus, apparently it will belong to the *Dasypogon* genus in *sensu stricto*. It should be easily recognized by the *wings*, which are brown on the fore border, by the absence of spines on fore tibiæ, and by the black *abdomen*, with broad reddish-yellow segmentations, the apex has spines ; no ovipositor visible. *Legs* yellowish. *Thorax* black, shoulders reddish. *Scutellum* reddish, with long yellow bristles. The brown colouring on the *wings* extends along the fore border to the apex, as far as the posterior branch of fork of third vein, fills the first basal cell, the extreme base of the first posterior, and only touches the discal cell on its border ; the fourth posterior cell is wide open, anal not quite closed.

Macquart gives the length as 6 lines.

From New S. Wales.

*Dasypogon albonotatus*, Macquart.

From Tasmania.

Described as having a long, slender, black *abdomen*, with white spots at sides of second to fifth segments. *Face* and *forehead* golden yellow. Beard and the plain moustache white. *Legs* red, the anterior tibiæ with a curved spine.

*Wings* hyaline, a little yellowish at base and on fore border, apex grey, fourth posterior cell closed.

Length 8 lines. ♂.

*Dasypogon nigripennis*, Macquart.

Type is probably lost. From New S. Wales.

Described as black. *Face* white, with a black moustache confined to oral opening. Beard black. *Palpi* black with black hairs. *Legs* black, the fore tibiæ with a curved spine. *Wings* violet-black, centre of cells yellowish. In the figure of wing the fourth posterior cell is practically closed at border and anal cell closed. The figure of head shows the *antennæ* with the third joint about the length of the first two, with a short terminal style.

*Dasypogon nigrinus*, Macquart.

Type, a male, seen by me in Paris Museum, 12. 4. 11.

Furnished with a spine on the fore tibiæ and the *abdomen* is club-shaped, but the short *antennæ* seem to preclude it from belonging to the genus *Brachyrrhopola* or *Codula*. *Face* not very broad; no tubercle; moustache confined to oral opening, composed of yellow bristles; the face is covered with yellow tomentum. *Palpi* black with black hairs. *Antennæ* very short, the third joint conical, about as long as the first two together, the latter with black hairs, on the second a very strong black bristle is present. *Thorax* black (denuded). *Abdomen* black (denuded). Macquart states the first two segments are shining black, the fifth and sixth with testaceous segmentations; no pubescence is visible, but some white hairs at sides; genitalia large, protruding, but not club-shaped; underside reddish with white hairs. *Legs* red, stout, shining; femora largely black; tarsi black; bristles on legs black and yellow. *Wings* dark brown, hyaline at base, only the apices of the basal cells being brown; the fourth posterior cell is a little narrowed at the border; the anal half open; the small transverse vein is below the middle of discal cell; Macquart's figure of wing gives this incorrectly, and also makes the fourth posterior cell too narrow at border.

Length 10 mm.

From Tasmania.

The species from New Guinea or other parts of the Australian region are:—

*Dasypogon oclusus*, Meijere, Nova Guinea, v. Zool. p. 75 (1906), which the author suggests may be the same or nearly allied to, *Stichopogon congressus*, Wlk.

The Walker types of the following species described from unknown localities are not to be found in the Brit. Mus. Coll., viz. *Dasypogon aphidnus*, *inserens*, and *occidens*, and might well be deleted from the list of species.

#### SELIDOPOGON, Bezzi.

Zeitschr. Hymen. u. Dipt. ii. p. 192 (1902).

Fore tibiae with a curved spine.

*Sclidopogon diadema*, Fabr., a European species extending to Asia Minor, has a number of synonyms, among others *Dasypogon punctatus*, Fabr., which Macquart records as from New Holland, stating that a female he had seen was similar to the European specimens: see Dipt. Exot. Suppl. iii. p. 180, (1818). I have not seen any specimens of this species from Australia.

The genus extends through Europe, N. Africa, Asia Minor, and the American continent.

#### STICHOPOGON, Loew.

Linn. Ent. ii. p. 499 (1847).

*Stichopogon congressus*, Walker.

Proc. Linn. Soc. London, v. p. 302 (1861) [*Dasypogon*]; Kertész, Cat. Dipt. p. 127 [*Dasypogon*] (1909); Meijere, Nova Guinea, v. Zool. p. 75 (1906).

*Stichopogon albicapillus*, v. d. Wulp, Tyd. v. Entom. (2) vii. (xv.) p. 147 (1872); Kertész, Cat. Dipt. p. 83 (1909). From New Guinea.

*Stichopogon scalaris*, Bigot, Ann. Soc. Entom. France, (5) viii. p. 440 (1878). From Fiji Islands.

Type (♂) from Tidore, Celebes, and a ♀ from Sula Island.

See v. d. Wulp for description of this species.

#### DIOCTRIA, Meigen.

Illiger's Magaz. f. Ins. ii. p. 270 (1803).

*Methylla*, Hansen, Fulnea oris Dipt. pp. 145 et 198 (1883).

The type of *D. claviventris*, Walker, from New Guinea, and *D. tasmanica*, Walker, from Tasmania, are both species of *Brachyrrhopola*, the latter being a synonym of *B. maculinevris*, Macq.

*D. conopsoides*, F., from Australia, was unknown to Wiedemann and Schiner. From the description it is impossible to ascertain what genus it belongs to; it would seem therefore best to expunge the name from list.

*D. horsleyi*, Walker, from unknown locality, is not a



species of *Dioctria*, though it bears a general resemblance to the genus and has a long third antennal joint; but the fore tibiæ are armed with a very distinct curved spine. It cannot belong to the genus *Cyrtophrys*, Loew, the *antennæ* having no apparent style. The *abdomen* is black, reddish at the apex.

LAPHIRINÆ.

Table of Genera.

- |  |                             |
|--|-----------------------------|
| 1. Fore tibiæ with a curved spine at apex .....  | 2.                          |
| Fore tibiæ with no curved spine at apex ....   | 3.                          |
| 2. Blue-black species marked with white abdominal spots. Moustache usually reaching nearly to antennæ, tubercle distinct on face . . . . . | <i>Thereutria</i> , Loew.   |
| Small species. Moustache confined to oral opening, no tubercle on face .....   | <i>Metalaphria</i> , g. n.  |
| 3. Posterior transverse vein in a straight line, or almost so, with the vein closing discal cell. . . . .                                  | 4.                          |
| Posterior transverse vein not so placed .....  | 6.                          |
| 4. Third joint of antennæ notched at apex, usually with a spine .....  | <i>Clariola</i> , Kertesz.  |
| Third joint of antennæ not notched .....   | 5.                          |
| 5. Abdomen punctuate, third joint of antennæ longer than the first two joints together ....  | <i>Atomosia</i> , Macquart. |
| Abdomen hardly punctuate, the third joint three times as long as the first two joints together .....                                       | <i>Aphestia</i> .           |
| 6. First posterior cell closed or very narrow. Abdomen bare .....  | <i>Nusa</i> , Walker.       |
| First posterior cell wide open or not very narrow .....  | 7.                          |
| 7. Moustache confined to oral opening. Head orbicular, very much excised behind .....  | <i>Maira</i> , Schiner.     |
| Moustache not confined to oral opening. Head semicircular, not usually so much excised behind .....  | <i>Laphria</i> , Meigen.    |

THEREUTRIA, Loew.

Progr. Realschule Meseritz, 1851, p. 20 (1851).

*Scandon*, Walker, Ins. Saund., Dipt. i. p. 108 (1851).

This genus was formed by Loew for a new species from Australia, viz. *Thereutria calcar*, which Loew made the type of the genus. He separated the genus from *Laphria* by the presence of the curved spine on the fore tibiæ. It is as yet peculiar to the Australasian region. The species are distinguished by the blue-black *abdomen* often marked with white spots, by the blue-black *legs*, the tibiæ or femora often yellow, the latter usually stout, curved, the *face* with a prominent tubercle covered by the thick moustache, with often long hairs continued to the base of the *antennæ*, which

last have the third joint broad, longer than the first two joints together. *Wings* with the first and fourth posterior cells open, the anal cell closed.

The species as yet recorded in this genus are :—

*Thereutria luctuosa*, Macq., Dipt. Exot. i. (2) p. 155 [*Dasypogon*] (1838).

*Thereutria amaracus*, Walker, List Dipt. ii. p. 380 [*Laphria*] (1849) et vii. Suppl. 3, p. 559 [*Laphria*] (1855).—*Ommatius ialmus*, Walker, l. c. p. 479 et p. 759. *Dasypogon diversicolor*, Macq., Dipt. Exot. Suppl. iv. p. 368 (1849); Bigot, Ann. Soc. Ent. France, (5) viii. p. 219 (1878). *Dasypogon aurifacies*, Macq., l. c. p. 367, pl. vi. fig. 5. *Thereutria calcar*, Loew, Progr. Realschule Meseritz, 1851, p. 20 (1851). *Scandon compacta*, Walker, Ins. Saund., Dipt. i. p. 108, pl. iv. fig. 7 (1851), et List Dipt. vii. Suppl. 3, p. 563 (1855). *Laphria diversipes*, Macq., Dipt. Exot. Suppl. v. p. 73 (1855); Froggatt, Australian Insects, p. 295 (1907). *Thereutria caligula*, Bigot, Ann. Soc. Ent. France, (5) viii. p. 233 (1878). *Dasypogon diversipes*, Kirby, Ann. Mag. Nat. Hist. xiii. p. 458 (1884).

*Thereutria pulchra*, Schiner, Reise Novara, p. 169 (1868).

### *Thereutria luctuosa*, Macquart.

Type, a male, seen in Paris Museum, 12.4.11, described by Macquart as from unknown locality: a label below gives "New Holland"; no doubt this is correct, as the genus, at any rate as yet, is peculiar to Australasia. It is a species of *Thereutria* distinguished from *T. amaracus* and *T. pulchra* by the wholly black *legs* and brown *wings*. A blue-black species. *Abdomen* with white spots at sides of segments 2-6. *Face* with white lines on each side, flat, hardly raised at oral opening. *Moustache* white. *Antennæ* gone, except the first two joints, which are black, with black pubescence. *Wings* brownish, the fourth posterior cell narrowed at border, the anal almost closed.

### *Thereutria amaracus*, Walker.

*Ommatius ialmus*, Wlk.  
*Dasypogon diversicolor*, Macq.  
*Dasypogon aurifacies*, Macq.  
*Thereutria calcar*, Loew.  
*Scandon compacta*, Wlk.  
*Laphria diversipes*, Macq.  
*Thereutria caligula*, Bigot.  
*Dasypogon diversipes*, Kirby.

Type (♂) from Hunter River, New S. Wales, and other specimens from Burpengary, Queensland, and New S. Wales.

Two male specimens from New S. Wales (presented by J. Hunter) were described by Walker as *Ommatius ialmus*; in both the third joint of antennæ is wanting and Walker

made no mention of them in his description; they appear to me identical with the above. The type of *Dasygogon aurifacies*, Macquart, a male, was seen by me in the Paris Museum, 12. 4. 11, and is a species of *Thereutria* identical with *Thereutria amaracus*, Walker.

The drawing of the wing by Macquart, pl. vi. fig. 5, is incorrect, the submarginal cell should be closed not open, and the small transverse vein is beyond the middle of the discal cell. Type has the moustache black, two female specimens with it have it yellow. *Antennæ* now wanting, except the first two joints, which are black with black pubescence. *Legs* reddish; the tibiæ pale yellow with black apices, the anterior pair with curved spine, no black stripe on the femora.

From New S. Wales.

Macquart's description precedes the one of *D. diversicolor*, which apparently is the same species. Bigot, who had the type before him, declared it to be a species of *Thereutria*.

Loew's species is no doubt identical, judging from the description. *Scandon compacta* was declared to be identical with it by Schiner; the type is not to hand. The type of *Dasygogon diversipes*, Kirby, is a female from Sidney, New S. Wales.

*Laphria diversipes*, Macq., was described from Sidney Island, Oceania, and is evidently the same as *T. amaracus*. Mr. Froggatt describes it as being a common insect about Sidney, often taken on fences.

The specimen, a female, described by Bigot as *T. caligula*, appears to be an example of this species, as the only difference in the short description is the mention of the upper side of femora being black; in one of the specimens in the Brit. Mus. Coll. of *T. amaracus* there is a black stripe, very short however, beginning at the apex. Bigot gave Australia as the locality.

The species may be identified by the almost wholly reddish-yellow *legs*, the femora being testaceous, the tibiæ yellow, only their apices, the coxæ, and tarsi being black. *Abdomen* blue-black, with the typical white side spots on the second to fifth segments. *Wings* with the first posterior cell rather narrow, narrower at the border, the fourth open at border but narrowed, the anal cell closed at border; the males mentioned above have the moustache black, in the females it is yellow, otherwise males and females seem identical.

*Thereutria pulchra*, Schiner.

Described from one male specimen, from New S. Wales.

In Brit. Mus. Coll. six males from Burpengary, Queensland (*Dr. T. L. Bancroft*).

A black species, distinguished from *T. amaracus* by the wholly black femora, and the tibiae are partly brassy yellow. Length 14 mm.

*Face* covered with yellowish tomentum. Moustache of black bristles surrounding mouth, not reaching up the face, tubercle small. *Antennæ* with black hairs on the first two joints. Beard white. Palpi with black hairs. *Forehead* with greyish tomentum and black hairs, hind part of head with black pubescence. *Thorax* with the usual white shoulder-spots and markings and with black pubescence. *Scutellum* black, with grey tomentum and black pubescence. *Abdomen* dull black, hardly shining, the white side-spots are present on the second, third, and fourth segments, covered with white hairs; sides of abdomen with white and black hairs; underside black. *Legs* slender, the femora not swollen; coxæ and femora black, with long white pubescence on the former and a few scanty white hairs on the latter, thickest on the posterior pair; fore tibiae blackish, a dull yellowish-red tinge on the apical two-thirds below, covered with fulvous pubescence which appears white above, the others are black, dull yellow on outer border, with dense white pubescence, on the black part it is black; tarsi black, the posterior pair with the first joint yellow; pubescence chiefly black; all bristles on the legs are black. *Wings* hyaline, veins brown, narrowly yellow on fore border; neuration as in *Thereutria amaracus*.

#### METALAPHRIA, gen. nov.

A genus next to *Thereutria*, having a curved spine to the fore tibiae. *Antennæ* with no style, the third joint long cylindrical. *Face* with no tubercle and the moustache confined to the oral opening. *Wings* with the first posterior cell widely open, the fourth very narrow at the border, almost closed, the anal cell the same.

The only species in general appearance resembles a *Saropogon* species.

#### *Metalaphria australis*, sp. n.

Type ♂, type ♀, from Upper Playford, Alexandria, N. Australia (*W. Stalker*), 1906.

A small species with a bluish-black *abdomen*, red at apex, with reddish-yellow *legs* and clear *wings*.

Length, ♂ 8 mm., ♀ 9 mm.



*Male*.—Face covered with pale golden-yellow tomentum. Moustache of fairly strong yellowish-white bristles round the oral opening. *Palpi* reddish yellow. Beard silvery white. *Antennæ* reddish yellow, the first two joints equal in length, with some short black pubescence and two stout bristles at apex of second joint; the third joint a little darker in colour, cylindrical, about one and a half times as long as the first two joints together. *Forehead* darker than face, with a few short black hairs and two black bristles on the ocelligerous tubercle; hind part of head with some bristly hairs, not at all excised behind. *Thorax* greenish brown, covered with yellowish-grey tomentum; a broad, brown, median stripe appears; beyond on each side three or more black short bristles are present, and on side of thorax just before the suture yellowish ones, and two longer weak ones beyond the base of wings; sides and breast with yellowish-grey tomentum. *Scutellum* same colour as thorax, armed with two yellowish bristles. *Abdomen* blue-black, shining and bare, the last two segments chiefly reddish; underside chiefly red. *Legs* reddish yellow, with some black bristles; hind femora almost bare, hardly incrassate. *Wings* clear; veins yellowish, the small transverse vein situated about the middle of the discal cell. Female is identical, the fourth posterior cell a little more open at border.

## CLARIOLA, Kertesz.

Termes Füzetek, xxiv. pp. 404–406 (1901).

Formed for *Clariola pulchra*, a male from New Guinea. The author places this genus between *Atomosia* and *Aphestia* in Schiner's table (Verh. zool.-bot. Ges. Wien, xvi. p. 662, 1866), from both of which it is distinguished by the peculiar third joint of *antennæ*, which has on the upper side before the middle a small projection with a spine, and also by its *Dioctria*-like appearance. *C. pulchra* is a small species, only 5.3 mm. The three new species from Queensland now added to this genus are large robust flies, very much larger than *C. pulchra*, and the projection on the third antennal joint is placed *beyond* the middle of the joint, otherwise they seem to agree in all the characters given of the genus, though the thorn or spine is not visible in one species, even when examined under a strong lens and magnified 28 times, but minute hairs fringe the apex.

1. Abdomen black, pubescence chiefly reddish brown. Legs yellowish ..... *pulchra*, Schiner.
- Abdomen and legs blackish, pubescence white. 2.

2. Moustache black and white. Abdomen with white-haired bands or spots on each segment. Wings brownish, yellower at base ..... *albohirta* sp. n.  
 Moustache white. Abdomen with the white pubescence only at base and apex. Wings blackish ..... *nigrescens*, sp. n.  
 Moustache reddish yellow. Abdomen with the white pubescence on apex. Wings blackish ..... *aurifacies*, sp. n.

*Clariola albohirta*, sp. n.

Types (♀ ♂) from Northern Queensland, and another female from Dandenong Ranges, Victoria, in Mr. French's collection.

A handsome, large, black species with brown *wings*, black *legs*, and *abdomen* marked with white-haired bands.

Length 19 mm.

*Face* with grey tomentum, which is whiter at the sides. Moustache consists of strong black bristles and some fine black and yellow hairs intermixed, reaching to the antennæ, in the ♀; in the male the moustache consists wholly of long silky yellow hairs; face with no perceptible tubercle; proboscis short, black; beard and hairs on under part of head white. *Antennæ* black, the first joint covered with grey tomentum in the ♀, cylindrical, longer than the second joint, which in the female is broader, both with black pubescence; on the underside of the first joint is a strong black bristle, and another is visible on the upper side of the second joint; in the male the one on the first joint is wanting; the third joint longer than the first two joints together, with the small tooth on the upper side towards the apex; the small spine Kertesz speaks of is not visible. *Forehead* black, with some grey tomentum and black hairs and bristles, the hairs on back of head chiefly whitish. *Thorax* blue-black, covered with very short grey pubescence, strong black bristles on the sides posteriorly, the pubescence longer at base of thorax and on the *scutellum*, which is armed with weak yellowish and black bristles. *Abdomen* blue-black, stout, one width throughout, shining, finely punctuated; the first two segments with silvery white hairs on their posterior borders, forming well-marked white bands; the third and fourth segments with only a few white hairs on the side anteriorly; the fifth segment with almost a complete white-haired band (in the male quite complete), the sixth segment with a complete white band, these last two bands are situated on the anterior borders of the segments; the seventh segment almost covered with white pubescence; sides of abdomen with some black bristles and fine hairs;

underside black. *Legs* long, fairly stout, blue-black; the coxæ with brown tomentum and black hairs, some white hairs on the anterior and middle ones; the femora with black pubescence, on their upper sides some fine white pubescence, which is thickest on the hind pair and extends below, a few yellow bristles appear on these last; tibiæ with dense white pubescence and with black bristles, the hind pair with a few yellow ones; the tarsi with chiefly black pubescence and bristles, but some white pubescence and a yellow bristle on first joint of posterior tarsi. *Wings* tinged brown, the subcostal cell ending in a point, the anterior branch of the third vein curved, the cross-veins closing the discal and fourth posterior cell almost in a line. Halteres yellow.

*Clariola nigrescens*, ♂ ♀, sp. n.

Type ♂, type ♀, and three other males from S. Queensland (*Bancroft*).

A black, robust, but smaller species than *C. albohirta*, to which it is closely allied; distinguished from it by the moustache being almost wholly white in both sexes, but chiefly by the white-haired bands of *abdomen* only being present on the first two segments, and the apex with white pubescence.

Length, ♂ 14 mm., ♀ 15 mm.

*Face* covered with whitish tomentum, yellower at the sides; moustache wholly whitish (♂), white, the oral opening bordered with black bristly hairs (♀); beard white. *Antennæ* black, the first joint with long white hairs below and a few short black ones above, the second joint with black hairs above and below and a black bristle on its upper side at apex (♀), two in the male; the spine on the tooth on upper edge is here plainly perceptible. *Forehead* blackish, with yellowish-grey tomentum and white pubescence, a few black hairs intermixed, more numerous in the female. Back of head with white hairs. *Thorax* shining bluish black, with short white pubescence anteriorly, elsewhere black. The white bands on *abdomen* are situated on posterior borders of segments; abdomen convex, finely punctured, sides after the second segment with black hairs, the last two segments with white hairs. *Legs* blue-black, all the bristles black; the posterior tibiæ with a dense white fringe of hairs below, otherwise similar to those of *C. albohirta*. *Wings* blackish, paler at base and on posterior border; neuration as in *C. albohirta*.

*Clariola aurifacies*, ♀, sp. n.

Type ♀ and another from Townsville, Queensland (F. P. Dodd), 29.iii.1902; and a male and female from Mackay, Queensland (G. Turner).

A species distinguished from *Clariola albohirta* and *Clariola pulchra* by the golden-haired face and hind part of head, and by the blackish wings.

Length 19 mm. The specimens from Mackay only 15 and 16 mm.

It differs from *Clariola albohirta* in the following particulars:—*Face* black, covered with bright golden tomentum and with the moustache reddish golden, thick, occupying the whole of the middle of face to base of antennæ. Beard same colour. *Palpi* small, black, with black hairs. *Antennæ* similar to those of *C. albohirta*, but the spine on the projection of the third joint is here visible and there are two bristles on the first joint. *Forehead* same colour as face. Hind part of head similar in colouring of pubescence to that of the face. *Thorax* shining, blue-black with very short yellowish-white pubescence, hardly visible to the naked eye, some black hairs on the posterior border, black bristles at the sides; sides and breast the same. *Scutellum* the same, bordered with black bristly hairs. *Abdomen* punctuated blackish with greenish reflections at the apex, the white pubescence is only visible on the last four segments, chiefly at the sides; pubescence on the dorsum black and short except at the apex, where it is whitish; sides with black pubescence; underside brownish. *Legs* with no white hairs on the coxæ, no white pubescence is visible on the femora nor white bristles on these or on the tibiæ; the tarsi have dense white pubescence like the tibiæ, only the posterior pair with chiefly black pubescence and no yellow bristles. *Wings* blackish, a little lighter on the posterior border and apex, viewed against the light they appear brownish with clear spaces; the other female has lighter wings than the type; veins black; neuration as in *C. albohirta*, with the exception of the cross-veins not being exactly in a line, the one which closes the third posterior cell being a little above the other; the female has a short appendix.

The species from other parts of the Australasian region will include, besides *Clariola pulchra*, two of Walker's species placed under *Laphria*, viz. *Laphria complens*, type, from Celebes, and *Laphria obliquistriga*, also from Celebes.

[To be continued.]



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# CONTENTS OF NUMBER 57.—*Eighth Series.*

	Page
XXXVI. The Classification of the Blennioid Fishes. By C. TATE REGAN, M.A. ....	265
XXXVII. Two new West-African Mammals. By OLDFIELD THOMAS .....	280
XXXVIII. Self-evisceration in the Asteroidea. By NATHANIEL COLGAN, M.R.I.A. ....	282
XXXIX. New Species of Heterocera from Costa Rica.—XVII. By W. SCHAUS, F.Z.S. ....	286
XL. Descriptions and Records of Bees.—XLVI. By T. D. A. COCKERELL, University of Colorado .....	311
XLI. Three new Species of Neotropical <i>Coccinellidae</i> . By GUY A. K. MARSHALL .....	320
XLII. Description of Two new Eels from West Africa, belonging to a new Genus and Family. By C. TATE REGAN, M.A. ....	323
XLIII. Notes on Malay Tigers, with Description of a new Form from Bali. By ERNST SCHWARZ .....	324
XLIV. Descriptions of some new Burmese Species of Ruteline Coleoptera belonging to the Genus <i>Anomala</i> . By GILBERT J. ARROW .....	327
XLV. On the Stromatoporoids and <i>Eozoön</i> . By R. KIRKPATRICK. (Plates VIII. & IX.) .....	341
XLVI. The Anatomy and Classification of the Teleostean Fishes of the Order Lyomeri. By C. TATE REGAN, M.A. ....	347
XLVII. A Revision of the <i>Asilidae</i> of Australasia. By GERTRUDE RICARDO .....	350

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XLVIII.—*Notes on Fossorial Hymenoptera*.—X.

By ROWLAND E. TURNER, F.Z.S., F.E.S.

*On new Species from the Oriental and Ethiopian Regions.*

Family *Psammocharidæ* (olim *Pompilidæ*).

*Ceropales pictus*, Shuck.

*Ceropales picta*, Shuck. Trans. Ent. Soc. London, ii. p. 70 (1837). ♀.

*Ceropales ruficollis*, Cam. Sjöstedt's Kilimandjaro-Meru Exp. ii. p. 260 (1910). ♀.

*Hab.* Cape Colony (*Shuckard*); British East Africa, Kikuyu Escarpment, Kijabe to Limoru, 7000 feet (*S. A. Neave*); Harar, Abyssinia (*G. Kristeussen*).

Abyssinian specimens are darker on the legs and antennæ, which are only irregularly tinted with fusco-ferruginous, not almost entirely ferruginous as in the typical form.

*Xanthampulex pernix*, Bingham.

*Ceropales pernix*, Bingham. Journ. Linn. Soc., Zool. xxv. p. 425 (1896). ♂.

This species, though near to *X. trifur*, Schulz, in colour, is probably distinct. The eyes are strongly convergent towards the clypeus, as in the other species of the genus. The sculpture differs somewhat from the description of *trifur*,

*Ann. & Mag. N. Hist.* Ser. 8. Vol. x.

especially on the head; but as the female only of *trifur* is known and the male only of *pernix*, there is a possibility that they are opposite sexes of the same species. *Ceropales parva*, Cam., which closely resembles *X. albovariegata* in colour, does not belong to the same genus, but I do not think that it is correctly placed in *Ceropales*, the eyes being without emargination.

*Xanthampulex albovariegata*, Cam.

*Ceropales albovariegata*, Cam. Mem. Manch. Lit. & Phil. Soc. xli. p. 84 (1896).

This species is mentioned, but without a name, by Schulz (Zool. Annal. iv. p. 145, 1911).

I cannot agree with Schulz as to the position of this genus, which I look on as closely allied to *Ceropales* in the structure of the pronotum and the emarginate eyes. The median segment is very unlike any of the Ampulicinæ, with which group Schulz connects the genus, and the frontal prominence is not similar in form to that in *Dolichurus*.

Family Crabronidæ.

Subfamily PEMPHREDONINÆ.

*Psen matalensis*, sp. n.

♀. Nigra; tegulis, tarsi intermediis et anterioribus, tibiisque basi testaceis; segmentis abdominalibus primo apice secundo lateribus ferrugineis.

♀. Clypeus covered with dense, fine, silver pubescence, more than twice as broad as long, the anterior margin very slightly rounded and shallowly emarginate in the middle, moderately convex and with a very obscure carina from the base to the apex. Antennæ inserted nearly twice as far from each other as from the eyes, and separated from the base of the clypeus by a distance equal to half the length of the clypeus, the first joint of the flagellum very short, partly concealed in the apex of the scape, less than one quarter of the length of the second joint, which is more than half as long again as the third joint, the apical joints thickened but all much longer than broad, the whole antenna about equal in length to the thorax and median segment combined. Head shining, sparsely and very finely punctured, a very short longitudinal carina between the antennæ, the eyes separated on the front by a distance equal to twice the length of the scape. Thorax shining and sparsely punctured; the

mesopleuræ sparsely clothed with white pubescence, a vertical carina below the anterior wings joining a wide shallow vertical groove, a few very short horizontal striæ behind the carina. Median segment short, the basal area shorter than the scutellum and strongly longitudinally striated, a deep groove running from the apex of the basal area to the apex of the segment, which is very steeply sloped behind the basal area and very coarsely rugose. Petiole as long as the thorax without the median segment, not grooved or carinated; the abdomen shining, very minutely punctured, the four apical segments with sparse, short, grey pubescence. Pygidial area well defined, elongate-triangular and very coarsely punctured. First recurrent nervure received before one-third from the base of the second cubital cell, the second received by the third cubital cell very near the base; the second cubital cell not more than one-third of the length of the third on the radial nervure.

Black; the tegulæ, intermediate and anterior tarsi, the base of the intermediate and anterior tibiæ, and the spines of the tibiæ and tarsi testaceous; the apex of the first abdominal segment most broadly on the sides and the sides of the second ferruginous. Wings hyaline, nervures black, the stigma fusco-ferruginous.

♂. As in the female, but the petiole is slightly longer and the ferruginous colour is more extensive on the second dorsal segment; the apical joint of the antennæ is light brown.

Length, ♀ 11, ♂ 9 mm.

*Hab.* Matala, Ceylon, 2000 feet (*P. Beirne*).

Types in B. M.

*Psenulus bicinctus*, sp. n.

♀. Nigra; segmentis abdominalibus secundo, quinto sextoque rufis; alis hyalinis.

Long. 8–9 mm.

♀. Clypeus very finely and closely punctured, thickly clothed with silvery-white pubescence, more than twice as broad as long, the anterior margin nearly straight, with two small teeth near the middle. Antennæ inserted a little further from each other than from the eyes, and separated from the base of the clypeus by a distance equal to the length of the clypeus, gradually thickened to the apex, shorter than the thorax and median segment combined; the second joint of the flagellum nearly as long as the first and third combined; a very narrowly V-shaped carina between the antennæ, which extends to a transverse feebly arched carina

less than halfway between the base of the antennæ and the clypeus, the transverse carina reaching halfway from the middle of the front to the eyes and produced upwards at its extremities so as to touch the base of the antennæ. Front between the eyes as broad as the length of the scape and three basal joints of the flagellum. Head shining, opaque on the front, closely and very minutely punctured; thorax shining, finely and rather sparsely punctured; mesopleuræ more closely and minutely punctured, with a deep vertical groove below the anterior wings. Median segment shining and almost smooth, with long white pubescence on the sides; a narrow transverse depression at the base, with about six short oblique carinæ on each side, produced in the middle and joining a deep longitudinal groove which reaches to the apex of the segment and is transversely striated. Abdomen smooth and shining, petiolate; the petiole as long as the posterior tibia, with a shallow and narrow groove from the base to the apex; pygidial area feebly defined, elongate-triangular and finely punctured. First recurrent nerve interstitial with the first transverse cubital nerve, second received by the third cubital cell very near the basal angle; the second cubital cell is less than half as long as the third on the radial nerve. Cubital nerve of the hind wing originating just beyond the apex of the anal cell.

Black; the second, fifth, and sixth abdominal segments entirely and the apical margins of the other segments very narrowly ferruginous red; spines of the tibiæ and tarsi testaceous. Wings hyaline, nervures black, stigma fusco-ferruginous.

Length 8–9 mm.

*Hab.* Shillong, Assam, 6000 feet (*Turner*). Four specimens.

#### Subfamily AMPULICINÆ.

##### *Dolichurus bipunctatus*, Bingh.

*Dolichurus bipunctatus*, Bingh. Journ. Linn. Soc., Zool. xxv. p. 439 (1896). ♂.

*Dolichurus reticulatus*, Cam. Ann. & Mag. Nat. Hist. (7) iv. p. 56 (1899). ♀.

*Hab.* Burma; Assam; Sikkim; Kangra Valley, N.W. India.

The female differs from *taprobanae*, Sm., in the slightly greater length of the median segment, the lesser development of the lateral spine on the posterior truncation of the median



segment, and the less strongly punctured front. The two species are very closely allied, and may possibly prove to be mere local forms of one species.

*Dolichurus taprobanæ*, Sm.

*Dolichurus taprobanæ*, Sm. Trans. Ent. Soc. London, p. 304 (1869). ♀.

Smith's type is a female, not a male as stated by him in the description. So far as I know, the male is unknown, but Bingham appears to have seen a male differing from his *bipunctatus*, unless, indeed, he has been misled by Smith.

*Hab.* Ceylon; Nicobar Isl.; Sikkim.

*Dolichurus gilberti*, sp. n.

♀. Nigra; segmentis abdominalibus 4-6 rufis; segmento mediano postice lateribus haud denticulatis.

Long. 9-10 mm.

♂. Omnino niger; fronte longitudinaliter striata.

Long. 6 mm.

♀. Eyes separated from each other on the vertex by a distance almost equal to the length of the second and third joints of the flagellum combined; the posterior ocelli very close together, nearly twice as far from the eyes as from each other. Front longitudinally striate-rugulose, the plate above the base of the antennæ smooth and shining; the space round the ocelli punctured; the vertex shining, with sparse and fine punctures. Clypeus with a longitudinal carina not reaching the apex. Second joint of the flagellum almost half as long again as the third. Thorax shining, finely punctured; mesopleuræ rugulose. Median segment broader than long, truncate posteriorly, the angles without spines, the dorsal surface transversely striated, with five longitudinal carinæ, the two lateral carinæ forming raised margins and meeting at the apex; the three middle carinæ not reaching the apex, the outer two parallel at the base, curved and forming a broad enclosed area posteriorly; the surface of the truncation coarsely rugulose. Abdomen smooth and shining. Spines of the tibiæ testaceous. First abscissa of the radius as long as the third, but a little shorter than the second.

♂. The carina of the clypeus reaches the apex; the surface of the frontal plate is punctured, not smooth, and the carinæ on each side of the median carina of the median segment are convergent towards the apex, not parallel at the base. The calcaria are whitish.

*Hab.* Shillong, Assam, 5000 feet (*G. Turner*) ; May, 5 ♀, 2 ♂.

The male differs from the European *D. corniculus*, Spin., in having the posterior ocelli nearer together and the front more coarsely sculptured, also in the convergence of the carinæ of the median segment. The female is without the lateral spines of the median segment, and has the posterior ocelli nearer together and the front more coarsely sculptured than in the same sex of *corniculus*. The shape of the cubital cells does not seem to be quite constant, and cannot be relied upon for small specific distinctions. It is just possible that this species may be identical with the S.-European *D. hæmorrhous*, Costa, which I have not seen. But Schulz (*Zool. Annal.* iv. p. 147, 1911) treats that form as a mere colour-variety of *corniculus*. From the similarly coloured *D. ignitus*, Sm. (syn. *D. tertius*, Sauss.), from S. Africa, this species differs in the sculpture of the front and median segment, in the lesser distance between the posterior ocelli, and the greater distance between the eyes on the vertex.

The female is the type.

#### Genus *TRIRHOGMA*, Westw.

##### *Trirhogma cærulea*, Westw.

*Trirhogma cærulea*, Westw. *Trans. Ent. Soc. Lond.* iii. p. 225 (1842). ♂ ; Westw. *Arc. Ent.* ii. p. 67 (1844). ♂ ♀.

It is remarkable that all males which I have seen from India are of the form *prismatica*, Sm., which has a large tubercle on the scutellum and the base of the mandibles white ; Westwood's description does not make any reference to these points, though taken from a North-Indian specimen. All females from India seem to be without the tubercle. Males in the British Museum collection from Celebes answer well to Westwood's description, and Colonel Bingham's account of *cærulea* ♂ (*Faun. Brit. Ind., Hym.* i. p. 262) seems to be taken from these rather than from Indian specimens. I have not seen the types, but if the type ♂ is similar to the Celebes form, I do not consider that it can be the ♂ of the usual Indian form, for which the name *prismatica*, Sm., would have to stand. A male from Hongkong in the British Museum collection has the tubercle on the scutellum less strongly developed than Indian specimens. I consider that only one species of the genus occurs in India.

*Ampulex approximata*, sp. n.

♀. Nigra; mandibulis, clypeo apice, scapo subtus pygidioque obscure fusco-ferrugineis; alis hyalinis, venis fuscis.

Long. 10 mm.

♀. Clypeus strongly convex, with a median carina, produced into a tooth at the apex, with a smaller tooth on each side. Head subopaque, microscopically punctured, the frontal carinæ very short, the median one scarcely developed and continued by a narrow and shallow sulcus which is lost halfway between the base of the clypeus and the anterior ocellus, the lateral carinæ extending very little above the base of the antennæ. Second joint of the flagellum nearly twice as long as the third. Eyes separated on the vertex by a distance equal to the length of the second joint of the flagellum; posterior ocelli nearer to each other than to the anterior ocellus. Thorax shining, very minutely punctured; the pronotum convex, longer than the breadth in the middle, with a narrow median sulcus from the base not reaching the apex, without a tubercle; mesonotum with an obscure median sulcus and a much deeper sulcus on each side, between which and the tegulæ is a deep depression. Scutellum with a depressed transverse row of very deep punctures at the base. Median segment longer than broad, with a distinct median carina and two slightly oblique lateral carinæ on each side, the space between the carinæ transversely striated, the distance between the carinæ at the base of the segment almost equal, the posterior angles of the segment without spines. The narrow petiole of the first abdominal segment is considerably shorter than the broadened portion of the segment; second segment distinctly longer than broad, the ventral surface rather strongly convex. The third dorsal segment has fine white pubescence at the base, the apical segment compressed laterally. Fourth tarsal joint reaching to the middle of the apical joint. Two cubital cells; the second abscissa of the radius a little longer than the first, the third half as long as the second.

*Hab.* W. India, Bombay Presidency.

Nearly allied to the European *A. fasciata*, Jur., from which it differs in the sculpture of the median segment, on which the carinæ are strongly developed, in the greater length of the second cubital cell, the almost complete absence of fuscous colouring on the fore wing, and the greater proportionate length of the second abdominal segment.

*Ampulex latifrons*, Kohl.

*Ampulex latifrons*, Kohl, Ann. natur. Hofmus. Wien, viii. p. 461 (1893). ♀.

*Ampulex brevicornis*, Cam. Entomologist, p. 312 (1902). ♀.

*Ampulex pulchriceps*, Cam. Ann. & Mag. Nat. Hist. (7) v. p. 38 (1900). ♂.

*Ampulex longicollis*, Cam.

*Ampulex longicollis*, Cam. Entomologist, p. 263 (1902). ♀.

*Ampulex trichosoma*, Cam. Ann. & Mag. Nat. Hist. (7) x. p. 55 (1902). ♂.

*Ampulex crudelis*, Bingham.

*Ampulex crudelis*, Bingham. Fauna Brit. India, Hym. i. p. 258 (1897). ♀.

*Ampulex trigona*, Cam. Entomologist, p. 264 (1902). ♀.

*Ampulex sodalicia*, Kohl.

*Ampulex sodalicia*, Kohl, Ann. naturh. Hofmus. Wien, viii. p. 417 (1893). ♀.

*Ampulex tricarinata*, Cam. Ann. & Mag. Nat. Hist. (7) ix. p. 245 (1902). ♀.

*Ampulex striatifrons*, Cam. Journ. Straits Br. Asiat. Soc. xxxvii. p. 95 (1902). ♂.

The type of Cameron's species from Borneo has the red colour of the hind and intermediate femora and coxæ very strongly suffused with green, but does not seem to differ otherwise.

*Hab.* Sikkim ; Assam ; Malacca ; Borneo.

*Ampulex hospes*, Sm.

*Ampulex hospes*, Sm. Cat. Hym. B. M. iv. p. 272 (1856). ♀.

*Ampulex foveifrons*, Cam. MS. ?

Specimens marked as type and co-type of *foveifrons* are in the British Museum, but I cannot find that the name has been published.

*A. cognata*, Kohl, is at most a local form of this species, differing in the more strongly punctured pronotum and the greater depth of the pronotal longitudinal furrow. The specimen recorded by Bingham from the Khasi Hills is now in the British Museum, and answers well to Kohl's description, being thus apparently identical with the Java variety rather than with Bornean specimens. Cameron, whose work on this genus is very careless, throws doubt on Bingham's record without any cause.



*Ampulex sibirica*, Fabr.*Sphex sibirica*, Fabr. Ent. Syst. ii. p. 207 (1793). ♂.*Ampulex sibirica*, Sm. Cat. Hym. B. M. iv. p. 209 (1856).*Ampulex compressiventris*, Guér. Iconogr. Règn. Anim., vii. Insect. p. 436 (1845). ♀.*Chlorampulex sibirica*, Sauss., Grandidier, Hist. Madagascar, xx. p. 444 (1892).

From an examination of the Fabrician type, I have no doubt that Saussure was quite correct in his identification of the species. He had probably seen the type, though he does not say so. Kohl, in his excellent monograph of the genus, does not seem to have thought of the possibility of this, and puts aside Saussure's identification too lightly. The locality given by Fabricius is, of course, erroneous, the species being West African.

Subfamily *SPHECINÆ*.*Sphex hæmorrhoidalis*, Fabr.*Sphex hæmorrhoidalis*, Fabr. Spec. Insect. i. p. 443 (1781).*Sphex nigripes*, Sm., var. *volubilis*, Kohl, Ann. naturh. Hofmus. Wien, x. p. 64 (1895).*Hab.* Sierra Leone; Uganda.

Type in the Banksian Collection.

The name *hæmorrhoidalis* must stand as the specific name and the name *nigripes*, Sm., as only subspecific. The typical form has the wings dark, whereas in the Indian form they are flavo-hyaline, clouded with fuscous at the apex. In specimens from Ceylon the wings are fusco-violaceous, as in the African form.

*Sphex (Parasphex) elegantulus*, sp. n.

♀. Nigra; albo-hirta, abdomine læte ferrugineo; petiolo segmentisque dorsalibus 3-5 nigris, lateribus ferrugineis, apice anguste flavo-testaceis; alis subhyalinis, venis fuscis.  
Long. 25 mm.

♀. Clypeus slightly convex at the base, flattened at the apex and broadly truncate, the base and sides closely covered with silvery pubescence intermixed with long white hairs. Eyes very slightly convergent towards the clypeus, separated on the vertex by a distance about equal to the length of the three basal joints of the flagellum combined. Posterior ocelli a little further from each other than from the eyes; second joint of the flagellum nearly twice as long as the

third. Head sparsely, thorax more closely punctured; scutellum without a median sulcus, slightly emarginate at the apex. Dorsal surface of the median segment narrow and very slightly concave, the sides above the spiracles smooth and shining, the rest of the segment covered with pubescence. Petiole fully half as long again as the broadened portion of the first dorsal segment, as long as the second, third, and fourth joints of the hind tarsi combined. Fifth ventral segment deeply emarginate at the apex,

*Hab.* Lo-Fou Mountains, S. China (*ex coll. Perkins*).

Very nearly allied to the common *S. viduatus*, Chr., from which it differs in the distinctly slenderer form, the greater proportionate length of the second joint of the flagellum, the smooth sides of the median segment above the spiracles, the absence of a sulcus on the scutellum, and the distinctly longer petiole. The sculpture of the dorsal surface of the median segment is somewhat concealed by pubescence, but is certainly not so strong as in *viduatus*.

#### Subfamily *PHILANTHINÆ*.

##### *Cerceris greeni*, sp. n.

♀. Nigra; clypeo, margine interiore oculorum sub insertione antennarum latissime, carina frontali, scapo subtus, macula post oculos, pronoto angulis posticis, tegulis macula parva, segmentis dorsalibus 2-3 fascia apicali angustissima, tibiis anticis et intermediis subtus, tarsisque anticis subtus albido-flavis; clypeo late emarginato, segmento mediano area basali longitudinaliter striata, segmento ventrali secundo area basali elevata nulla; alis fusco-hyalinis, cæruleo-tinctis.

Long. 14 mm.

♀. Eyes divergent towards the clypeus; posterior ocelli more than half as far again from the eyes as from each other. Mandibles with a triangular tooth on the inner margin a little before the middle. Clypeus very widely emarginate, the angles of the emargination slightly produced and forming short teeth; a very short longitudinal carina just before the teeth. Head very broad; the cheeks nearly as broad as the eyes; the clypeus short, subconcave, very broadly truncate at the base, separated from the base of the antennæ by a distance equal to the length of the second joint of the flagellum, which is almost equal in length to the first and third joints combined. Pronotum transverse, the margins slightly raised. Head and abdomen rather closely and not finely punctured; thorax coarsely and closely punctured,

the postscutellum almost smooth, the triangular area at the base of the median segment strongly longitudinally striated. First abdominal segment twice as broad as long; pygidial area transversely rugulose, nearly three times as long as broad, the sides almost parallel, truncate at the apex. Ventral segments more sparsely and finely punctured; second segment without a raised basal area, sixth segment deeply and narrowly emarginate and ending in two small spines on each side, the outer spine the shortest. First recurrent nervure received at three-fifths from the base of the second cubital cell, second at about one-sixth from the base of the third cubital cell.

*Hab.* Kharkur, Nilgiris, S. India (*E. E. Green*); May 1910.

Type presented to the British Museum by the Bombay Natural History Society.

This is another species of the small group of which *ferox*, Sm., may be taken as the typical species. The group hitherto has only been known from Borneo, Sumatra, Siamese Malaya, and Southern Burma.

#### Subfamily *BEMBECINÆ*.

##### *Bembex scotti*, sp. n.

♂. Niger; clypeo albido, nigro bimaçulato; labro scapoque subtus pallide flavis; mandibulis basi, carina frontali, linea post oculos pedibusque flavis; pronoto linea postice, callis humeralibus, mesonoto lateribus et macula parva utrinque in medio marginis postici, scutello postscutelloque fascia subapicali, segmento mediano fascia arcuata angulisque anticis et posticis, mesopleuris macula magna, segmento dorsali primo fascia late emarginata, segmentis 2-6 fascia bisinuata, septimo macula magna basali, segmentisque ventralibus basi nigris, secundo macula magna triangulari nigra, flavo-olivaceis; segmento dorsali septimo spinis lateralibus; alis hyalinis, venis fuscis.

Long. 16 mm.

♂. Basal joint of fore tarsi with seven spines, all the tarsi, tibiæ, and femora simple, not broadened or serrate. Clypeus not very strongly serrate, a distinct carina between the antennæ; eyes almost parallel. Four apical joints of the flagellum excavate beneath, the apical joint longer than the penultimate, slightly curved, rounded at the apex, the ninth to eleventh joints of the flagellum slightly produced beneath at the apex, the sixth joint a little thickened at the apex, the seventh at the base beneath, but not spinose. Second ventral segment without a carina; sixth with a delicate carina on

the apical half, shallowly sinuate at the apex; seventh unarmed. Seventh dorsal segment narrowly rounded at the apex, with a spine on each side near the base.

♀. Second ventral segment shining and very sparsely punctured in the middle; sixth dorsal segment subtriangular, rounded at the apex.

*Hab.* Zungeru, N. Nigeria; November 1910 (*J. W. Scott-Macfie*).

Very nearly allied to *B. bidentata*, Lind., but the intermediate femora of the male are not toothed, the shape of the seventh dorsal segment is different in both sexes, and the colouring is very different.

*Bembex johnstoni*, sp. n.

♂. Niger; mandibulis, apice nigris, labro, clypeoque maculis binis nigris, flavis; antennis, pedibus capiteque (vertice nigro excepto) ochraceis; pronoto, tegulis, lateribus mesonoti, segmentisque abdominalibus sexto septimoque fusco-ferrugineis; abdomine obscure iridescenti; alis hyalinis, venis fuscis.

Long. 24 mm.

♂. Antennæ with the three apical joints strongly excavated beneath, the apical joint much longer than the penultimate, slightly curved and rounded at the apex, the eighth and ninth joints of the flagellum with a small spine beneath, the sixth emarginate beneath, the seventh with a very minute spine near the base. Eyes almost parallel on the inner margin; front distinctly carinated between the antennæ, the carina continued on the base of the clypeus, which is strongly convex. Fore tarsi normal, the basal joint with seven spines on the outer margin; none of the femora serrate, intermediate tibiæ not produced at the apex, basal joint of intermediate tarsi normal. Second ventral segment with a low longitudinal carina ending in an acute spine, sixth segment produced and bluntly tuberculate at the apex, seventh segment with an indistinct median carina. Seventh dorsal segment narrowly rounded at the apex, the sides not sinuate. Finely and closely punctured, the ventral segments more sparsely punctured. The apical margins of the dorsal abdominal segments are very narrowly tinted with testaceous, the whole abdomen with a blue iridescent sheen. Wings very feebly tinted with fuscous towards the base.

*Hab.* Uganda (*Sir H. Johnston*).

Allied to *B. möbi*, Handl., but in that species the seventh dorsal segment is toothed at the sides. In the type of the present species, however, the seventh segment is so much



withdrawn that it is quite possible that the spines are really present, though I cannot see them. The colour is very distinct, the apical dorsal segment is narrower at the apex and rounded, not subtruncate as in *möbii*, and the structure of the eighth and ninth joints of the flagellum is different.

*Bembex albofasciata*, Sm.

*Bembex albofasciata*, Sm. Ann. & Mag. Nat. Hist. (4) xii. p. 296 (1873). ♂.

*Bembex karschii*, Handl. Sitzungsab. Akad. Wiss. Wien, cii. p. 742 (1893). ♂ ♀.

These descriptions undoubtedly refer to the same species. The range does not appear to be very extensive, the series in the National Collection being mostly from the Southern Transvaal, with one or two specimens from Basutoland and Zululand.

*Bembex diversipennis*, Sm.

*Bembex diversipennis*, Sm. Ann. & Mag. Nat. Hist. (4) xii. p. 297 (1873). ♂ ♀.

The localities in the National Collection are from Angola to Nyasaland, Mashonaland, and Harar, Abyssinia.

Subfamily NYSSONINÆ.

Genus AMMATOMUS, Costa.

*Ammatomus*, Costa, Fauna Napoli, Nyssonid. p. 36 (1859).

*Gorytes*, Handl. (pars) Sitzungsab. Akad. Wiss. Wien, xcvi. p. 317 (1888).

*Tanyoprymnus*, Cam. Trans. Amer. Ent. Soc. xxxi. p. 375 (1905).

I cannot agree with Handlirsch in sinking this genus in *Gorytes*, though I think that Ashmead goes too far in removing it from his family Nyssonidæ and placing it with his Stizidæ. In addition to the list of species given by Handlirsch in the supplement to his most valuable monograph as belonging to the species group of *coarctatus*, Spin. (*Ammatomus*), the following species should be included:—

*A. alipes*, Bingham. Fauna British India, Hymen. i. p. 273 (1897). (*Gorytes a.*)

*A. ornatus*, Sm. Trans. Ent. Soc. London, p. 248 (1868). (*Gorytes o.*) (nec Sm. 1856). Syn. *Gorytes decoratus*, Handl.

*A. icarioides*, Turn. Proc. Zool. Soc. London, p. 499 (1908). (*Gorytes i.*)

*A. longitarsis*, Cam. Trans. Amer. Ent. Soc. xxxi. p. 376 (1905). (*Tanyoprymnus l.*)

The latter is probably a synonym of *A. moneduloides*, Pack.

I suspect that *A. rufonodis*, Rad., will prove to be a synonym of *A. amatorius*, Sm.

The genus seems to me to be most nearly related to *Kohlia*, Handl., though differing in the convergence of the eyes and the clavate antennæ.

*Ammatomus africanus*, sp. n.

♀. Nigra; clypeo, fronte sub antennis, scapo subtus, pronoto postice angustissimo, mesonoto macula minuta angulis posticis, segmento dorsali primo macula transversa utrinque, segmentis 2-5 fascia angusta apicali, tibiis supra tarsisque albido-flavis; alis hyalinis, venis nigris.

Long. 9 mm.

♀. Eyes strongly convergent towards the clypeus, at the base of which they are separated by a distance equal to about two-thirds of the length of the scape; posterior ocelli nearly twice as far from each other as from the eyes. Antennæ clavate, the four apical joints as broad as long or broader. Opaque, covered with very delicate, close-lying, white pubescence; head almost smooth, with a well-marked frontal sulcus reaching the anterior ocellus; thorax and median segment sparsely punctured; the basal area of the median segment distinctly defined, triangular, and very sparsely punctured. Mesopleuræ rather closely punctured, the sides of the median segment almost smooth, with a few scattered punctures. Abdomen shallowly and rather sparsely punctured; first segment narrow, nearly three times as long as the apical breadth, of almost equal width throughout, not constricted or inflated at the apex, about equal to the second segment in length, but not more than one-third of the apical breadth of the second segment. Hind tarsi very long and slender, fully as long as the tibia and femur combined; hind tibiæ with very short feeble spines; anterior tarsi without a comb. Second abscissa of the radius about equal to the first, but distinctly less than half as long as the third. Both recurrent nervures received by the second cubital cell, the distance between them on the cubitus slightly exceeding the length of the second abscissa of the radius (in one specimen slightly less). Cubitus of hind wing originating a little before the transverse median nervure.

The yellow band at the apex of the second dorsal segment is narrowly interrupted in the middle.

*Hab.* Pakasa, N. Rhodesia (*Silverlock*); January, 2 ♀ ♀.

This is the first species of the genus recorded from the

Ethiopian Region. It seems to be most nearly allied to *mesostenus*, Handl., which I have not seen, but is more finely and sparsely punctured. As in other species of the genus, there is a strong elbow close to the cubitus on the first transverse cubital nervure, from which on the inner side branches the stump of a nervure continued as a scar to the base of the stigma.

*Gorytes (Harpactus) escalerae*, sp. n.

♀. Nigra; clypeo, mesopleuris, scutello, postscutello, segmento dorsali secundo basi et linea lata, longitudinali, mediana, segmento ventrali secundo fascia lata interrupta, segmentoque quinto dorsali albido-flavis; alis fusco-hyalinis, venis fuscis.

Long. 7 mm.

♀. Eyes almost parallel on the inner margin; posterior ocelli twice as far from each other as from the eyes. Clypeus broad, transverse at the apex. Head and thorax opaque, very finely and closely punctured, mesopleuræ and abdomen more sparsely but a little more deeply punctured and shining; a transverse crenulated groove between the mesonotum and the scutellum. Second ventral segment only slightly convex; first abdominal segment broad and short; pygidial area well defined, flat, rather narrowly triangular, and more deeply punctured than the other segments. Basal area of the median segment well defined, coarsely longitudinally rugose-striate, with a distinct median sulcus. Third abscissa of the radius longer than the second by one-quarter, both recurrent nervures received by the second cubital cell, the distance between them on the cubitus scarcely greater than that between the second recurrent nervure and the apex of the second cubital cell. Cubitus of the hind wing originating distinctly beyond the transverse median nervure.

*Hab.* Mogador, S.W. Morocco (*Escalera*).

The absence of the ferruginous colouring prevalent in the group and the great extent of the yellow markings on the mesopleuræ and second abdominal segment distinguish this species at a glance. It is more robust than most of the allied species, and the pygidial area is more distinctly margined.

Subfamily *CRABRONINÆ*.

*Rhopalum seychellense*, nom. n.

*Crabro* (*Rhopalum*) *oceanicus*, Turn. Trans. Linn. Soc., Zool. (2) xiv. p. 373 (1911).

Nec *Crabro* (*Rhopalum*) *oceanicus*, Schulz, Spolia Hymen. p. 202 (1906).

The name *oceanicus*, being preoccupied, has to be changed, Schulz having priority.

*Dasyproctus opifex*, Bingham.

*Crabro opifex*, Bingham. Faun. Brit. India, Hym. i. p. 323 (1897). ♀.

*Dasyproctus buddha*, Cameron.

*Rhopalum buddha*, Cameron. Mem. Manch. Lit. & Phil. Soc. (4) ii. p. 18 (1889). ♂.

*Crabro buddha*, Cameron. Mem. Manch. Lit. & Phil. Soc. (4) iii. p. 270 (1890). ♂; Bingham. Faun. Brit. India, Hym. i. p. 323 (1897). ♂.

*Crabro brookii*, Bingham. Journ. Linn. Soc., Zool. xxv. p. 444 (1896). ♀.

I think there can be no doubt that *buddha* and *brookii* are sexes of one species.

*Dasyproctus orientalis*, Cameron.

*Crabro orientalis*, Cameron. Mem. Manch. Lit. & Phil. Soc. (4) iii. p. 272 (1890).

*Dasyproctus solitarius*, Smith.

*Crabro solitarius*, Smith. Journ. Linn. Soc., Zool. iii. p. 162 (1858). ♀.

*Crabro (Ceratocolus) alatus*, Panzer.

*Crabro alatus*, Panzer. Faun. Insect. Germ. iv. (1797).

*Crabro quadriceps*, Bingham. Faun. Brit. India, Hym. i. p. 327.

*Hab.* Kumaun.

This wide-ranging species extends to N. China and N.W. India.

*Crabro auricomus*, Bingham.

*Crabro auricomus*, Bingham. Faun. Brit. India, Hym. i. p. 327 (1897). ♀.

*Crabro khasianus*, Cameron. Ann. & Mag. Nat. Hist. (7) x. p. 61 (1902). ♀.

There is only a slight colour-difference between the types. The species seems to me to be a *Crabro* of the same group as *C. fossorius*, but I cannot see the structure of the mandibles distinctly. The striation of the mesonotum is transverse, not longitudinal.

*CRABRO*, subgenus *SOLENIUS*.

It is unfortunate that Ashmead, in selecting a type for *Solenius*, Lep., should have departed from Kohl's indication of the typical forms of the group and selected *C. interruptus*,



Lep., a North-American species, as the type. Kohl's indication can hardly be accepted as fixing the type, as he mentions two species, *C. vagus*, Linn., and *C. dives*, H.-Sch., as examples of the group. It would certainly have been more convenient if Ashmead had followed Kohl and selected *C. vagus* as the type of *Solenius*. The valuable work done by American authors in revision of nomenclature is unfortunately sometimes disfigured by inconvenient changes which might easily have been avoided. *C. vagus* and the allied eastern forms differ from Ashmead's definition of *Solenius* in not having the abdominal segments constricted and strongly punctured, and eventually may have to be separated. Provisionally the following species may be placed in *Solenius*, being allied to *C. vagus*, most of them having been described as *Crabro* without any definite indication of the subgenus to which they belong. In nearly all the specimens I have examined the mandibles are closed, and I have often been unable to distinguish clearly the tooth on the inner margin near the base.

#### ASIATIC SPECIES.

*Crabro (Solenius) agycus*, Cam.

*Crabro agycus*, Cam. Entomologist, p. 261 (1904).

*Crabro (Solenius) palitans*, Bingham.

*Crabro palitans*, Bingham, Proc. Zool. Soc. p. 446 (1896).

*Crabro (Solenius) alacer*, Bingham.

*Crabro alacer*, Bingham, Proc. Zool. Soc. p. 443 (1896).

#### XLIX.—*The Osteology and Classification of the Teleostean Fishes of the Order Apodes.* By C. TATE REGAN, M.A.

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#### Order APODES.

Malacopterous physostomes with the pelvic fins, when present, abdominal. Body elongate, cylindrical, or compressed; scales vestigial or absent; gill-openings restricted; dorsal and anal fins contiguous to or continuous with the reduced caudal, when this is present; pectoral fins small and

pelvics usually absent. Præmaxillaries not developed as distinct elements; maxillaries bordering the mouth, separated anteriorly by the ethmoid\*; hyo-palatine bones reduced to 2 or 3, hyomandibular, quadrate, and palatopterygoid, the last sometimes absent; lower jaw of dentary and articulare; opercular bones small, the membrane covering the large branchial chambers chiefly supported by the long branchiostegals. A single pair of dentigerous upper pharyngeals, opposed to the separate lower pharyngeals. Skull long and low; præmaxillaries, mesethmoid, and lateral ethmoids represented by a single dentigerous† bone; parietals meeting in front of the supraoccipital; no exoccipital condyles‡; no opisthotic, but other otic bones well developed; pterotic extending forward above sphenotic to alisphenoid; paired§ orbitosphenoids; no basisphenoid. No post-temporal; supra-cleithrum attached by ligament to the vertebral column; hypercoracoid and hypocoracoid small, laminar; no mesocoracoid. Vertebrae numerous; arches ankylosed to centra; præcaudals with strong parapophyses bearing the ribs; epineurals and epipleurals usually present. Gonoducts reduced to genital pores.

The peculiarities of the skull, jaws, suspensorium, and pectoral arch separate the Apodes very sharply from the Isospondyli, of which they must be regarded as an offshoot. They correspond to the family Muraenidæ of Günther after removal of the Saccopharyngidæ, now generally regarded as comprising a separate order, Lyomeri (see 'Annals,' Sept. 1912, p. 347).

Except for the elevation of the subfamilies to family rank and the addition of the more recently discovered Urenchelidæ,

\* According to Boulenger (Camb. Nat. Hist. p. 600) the maxillaries of the Muraenidæ are palato-pterygoids. I find that in all their relations these bones are the same in the Muraenidæ as in the other families; distally they are external to the mandibles; moreover the true palatopterygoids are present in the usual place, but reduced to mere threads of bone.

† In *Heterenchelys* and also in *Synaphobranchus* the vomerine teeth are separated by an interspace from the præmaxillary teeth and the vomer is a distinct bone. It can hardly be doubted that the dentigerous bone in front of the vomer and between the maxillaries represents the præmaxillaries ankylosed to the mesethmoid.

‡ As in the Isospondyli an anterior half-centrum is very firmly united to the basi- and exoccipitals.

§ The orbitosphenoids lie in front of the alisphenoids and usually separate the parasphenoid from the frontals; rarely (*Moringua* and sometimes in *Anguilla*) the parasphenoid and frontals meet, concealing the orbitosphenoids.

Simenchelidæ, Ilyophidæ, and Dyssomidæ, Günther's arrangement (Cat. Fish. viii. p. 19) is the one still in general use (*cf.* Jordan & Evermann, 'Fishes of N. America,' p. 345).

Gill (Proc. U.S. Nat. Mus. xiii. 1890, pp. 157-170, 231-242) has added considerably to our knowledge of the diagnostic characters of the Anguillidæ, Simenchelidæ, Synphobranchidæ, Murænesocidæ, and Murænidæ. Mlle. Popta (Ann. Sci. Nat. (8) xix. 1905, p. 367) has described the pharyngeals in a number of types.

*Synopsis of the Families.*

- I. Caudal fin free ..... 1. *Urenchelidæ*.
- II. Caudal fin, when present, continuous with dorsal and anal; no pelvic fins.
- A. Frontals paired, united by suture.
1. Jaws not produced, the snout conical or obtuse,
- a. Otic bulla little inflated.
- α. Pharyngeals oblong or ovate, covered with small teeth; caudal vertebræ without transverse processes.
- \* Pharyngeal openings of branchial clefts wide; palato-ptyergoid well developed; pectoral fins present.
- Mouth with lateral cleft; 8 pectoral radials .. 2. *Anguillidæ*.
- Mouth transverse; 4 pectoral radials ..... 3. *Simenchelidæ*.
- \*\* Pharyngeal openings of branchial clefts narrow.
- Palato-ptyergoid an elongate lamina; no pectoral fins ..... 4. *Xenoco-gridæ*.
- Palato-ptyergoid very slender, almost vestigial; pectoral fins present ..... 5. *Myrocongridæ*.
- β. Upper and lower pharyngeals with strong biserial teeth, elongate, supported by the enlarged fourth epi- and cerato-branchials; caudal vertebræ with transverse processes; pharyngeal openings of branchial clefts narrow; palato-ptyergoid very slender, almost vestigial; no pectoral fins ..... 6. *Murænidæ*.
- b. Prootic and basioccipital forming a prominent bulla; eyes very small; vertical fins well developed only near end of tail; pectorals vestigial or absent.
- Heart just behind gills; palato-ptyergoid well developed; pharyngeal openings of branchial clefts wide ..... 7. *Heterenchelidæ*.
- Heart far behind gills; palato-ptyergoid vestigial; pharyngeal openings of inter-branchial clefts narrow ..... 8. *Moringuidæ*.
2. Jaws much produced, the snout long and slender; no palato-ptyergoid; pharyngeal openings of branchial clefts wide.
- Suspensorium vertical; vent near gill-openings and tail very long; vertebræ very numerous ..... 9. *Nemichthyidæ*.
- 26\*

- Suspensorium directed obliquely backwards;  
vent equidistant from gill-openings and  
end of short tail; vertebræ about 80 .... 10. *Cyemidæ*.
- B. Frontals ankylosed to form a single bone; pharyngeals oblong or  
ovate, covered with small teeth; pharyngeal openings of  
branchial clefts wide.
1. Jaws strong; suspensorium vertical or directed obliquely  
forwards; palato-pterygoid well developed as an elongate  
lamina.
- a. Nostrils superior or lateral; neural spines long and slender.  
Maxillaries articulating with ethmoid at some  
distance from end of snout; caudal ver-  
tebræ without transverse processes ..... 11. *Muraenesocidæ*.
- Maxillaries articulating with ethmoid near end  
of snout; caudal vertebræ with transverse  
processes ..... 12. *Congridæ*.
- b. Nostrils labial; neural spines vestigial; maxillaries articu-  
lating with ethmoid near end of snout; caudal vertebræ  
with transverse processes.
- Caudal fin present; ribs strong ..... 13. *Echelidæ*.  
No caudal fin; ribs feeble ..... 14. *Ophichthyidæ*.
2. Jaws slender; suspensorium directed obliquely backwards.
- Gill-openings well separated; vent remote from  
head ..... 15. *Ilyophidæ*.
- Gill-openings well separated; vent not far be-  
hind them; no palato-pterygoid ..... 16. *Dysommidæ*.
- Gill-openings confluent; palato-pterygoid very  
slender, almost vestigial ..... 17. *Synaphobranchidæ*.

### Family 1. Urenchelidæ.

Cretaceous eels with the caudal fin free from the dorsal and anal. Several species of *Urenchelys* have been described by Smith Woodward (Cat. Foss. Fish. iv. p. 337, 1901). *Anguillavus bathshebæ*, Hay (Bull. Amer. Mus. xix. 1903, p. 439, pl. xxxvii. fig. 1), from the Upper Cretaceous of Mount Lebanon, is of great interest as an undoubted eel with pelvic fins; these are small, 8-rayed, abdominal in position.

I here designate this species as the type of the genus *Anguillavus*, for, in my opinion, *Anguillavus quadripinnis* (Hay, t. c. p. 437, pl. xxxvi. figs. 2 & 3) is the representative of another genus, and probably not an eel at all. Although the body as far back as the pelvic fins is preserved, there is no trace of the dorsal fin, which begins just behind the head in *Anguillavus* and *Urenchelys*; on the other hand, there are traces of lateral rows of bony plates, unknown in these genera.

Dr. Hay's description of maxillæ "parallel with the premaxillæ," and of supramaxillæ, palatines, entopterygoids,



ectopterygoids, and præfrontals, is not in accord with the systematic position assigned to this fish, and his figure leads me to believe that it may belong to the family Dercetidæ and possibly to the genus *Leptotrachelus*.

### Family 2. Anguillidæ.

Dorsal and anal continuous with the reduced caudal; pectorals present; body scaly; vent remote from head. Mouth terminal, with lateral cleft extending to below eye; maxillary articulated with ethmoid near end of snout; teeth small, cardiform or villiform, in bands; nostrils lateral; gill-openings well separated; pharyngeal apertures of branchial clefts wide. Frontals paired; vomer ankylosed to ethmoid; suspensorium directed obliquely forwards; palato-pterygoid well developed as an elongate lamina. 8 pectoral radials. Neural spines slender, free; no lateral transverse processes (additional to parapophyses or hæmal arches) on caudal and posterior præcaudal vertebræ; ribs and intermuscular bones feeble.

A single genus, *Anguilla*.

### Family 3. Simenchelidæ.

*Simenchelys parasiticus* differs from *Anguilla* in the transverse mouth, blunt uniserial teeth, and very large tongue; in osteological characters it is very similar to the Anguillidæ, but there are only 4 pectoral radials. The recently described *Gymnosimenchelys*, Tanaka, is naked and has pluriserial teeth.

### Family 4. Xencongridæ.

*Xenconger fryeri*, from Assumption (Regan, Trans. Linn. Soc. 1912), differs from the Anguillidæ in the absence of scales and of pectoral fins and in the small pharyngeal apertures of the branchial clefts. I have ascertained that the frontals are paired, the palato-pterygoids are developed as elongate laminae, and the caudal vertebræ lack lateral processes.

### Family 5. Myrocongridæ.

Naked, but traces of large regularly arranged scale-pouches on the thorax; body compressed, with the tail longer than the trunk and the vertical fins well developed; pectorals present. Mouth terminal, with lateral cleft extending a little behind eye; maxillary articulating with ethmoid near end of

snout; teeth cardiform, in bands; nostrils lateral; gill-openings well separated; pharyngeal apertures of branchial clefts restricted; pharyngeals ovate or oblong, covered with small teeth. Frontals paired; suspensorium vertical; palatopterygoid very slender, not laminar. 4 pectoral radials. Neural spines long and slender; caudal vertebræ without transverse processes.

*Myroconger compressus*, from St. Helena, appears to be quite as closely related to the Anguillidæ as to the Murænidæ.

#### Family 6. **Murænidæ.**

Naked, compressed or cylindrical; vertical fins variously developed; no pectorals. Mouth terminal, with lateral cleft extending behind eye; maxillary articulated with ethmomer at some distance from end of snout; teeth strong, acute or obtuse, in one or more series; nostrils lateral; gill-openings well-separated; pharyngeal apertures of branchial clefts restricted; upper and lower pharyngeals bearing strong curved teeth in a double series, elongate, supported by the enlarged epi- and ceratobranchials of the fourth arch. Frontals paired; hyomandibular with broad head; palatopterygoid very slender, almost vestigial. Neural spines developed in caudal region only, short, laminar; caudal vertebræ with lateral transverse processes.

*Muraena*, *Gymnothorax*, *Echidna*, *Strophiodon*, *Thyrsoidea*, *Rhinomuraena*, *Muraenoblenna*, *Channomuraena*, *Enchelychore*, &c., from tropical and temperate seas.

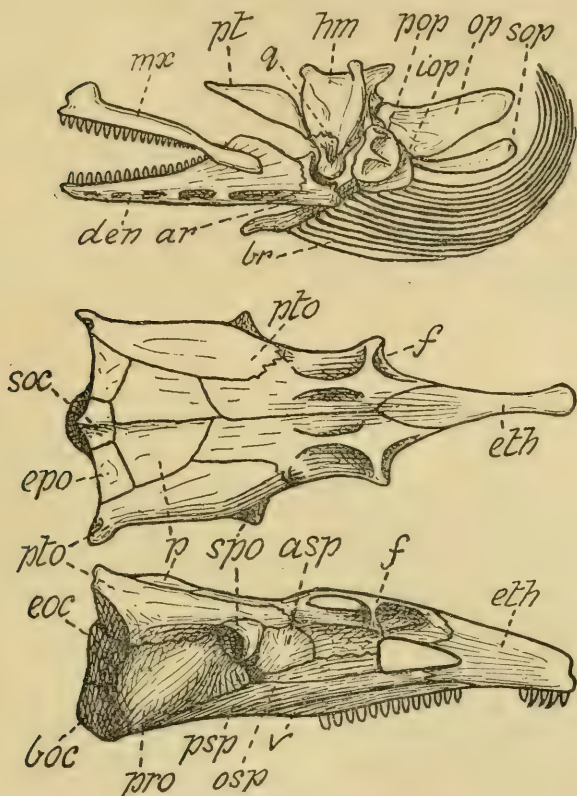
#### Family 7. **Heterenchelidæ.**

Naked, cylindrical, with the tail much longer than the trunk; vertical fins well developed only towards the end of the tail; pectorals absent. Mouth moderate, with lateral cleft extending behind the very small eye; maxillary articulating with ethmoid near end of snout; teeth conical, biserial; nostrils lateral; gill-openings separate; pharyngeal apertures of branchial clefts wide; pharyngeals oblong or ovate, covered with small teeth. Heart just behind the gills. Frontals paired, anteriorly with strongly developed mucous channels; vomer distinct, united by suture with ethmoid; orbitosphenoids long and narrow, separating parasphenoid from frontals; prootic and basioccipital swollen to form a thin-walled bulla containing a large otolith. Suspensorium vertical; palatopterygoid a rather broad lamina. Neural

spines short, laminar; neural arches without zygapophyses; caudal vertebræ without lateral transverse processes; ribs and intermuscular bones feeble.

*Heterenchelys*, with two species from West Africa ('Annals,' Sept. 1912, p. 323).

Fig. 1.



*Heterenchelys macrurus*. Jaws, hyo-palatine, and opercular bones, and skull from above and from the side.

*mx*, maxillary; *den*, dentary; *ar*, articular; *pt*, palato-pterygoid; *hm*, hyomandibular; *q*, quadrate; *pop*, præoperculum; *op*, operculum; *sop*, suboperculum; *iop*, interoperculum; *br*, branchiostegals; *eth*, ethmoid; *v*, vomer; *f*, frontal; *p*, parietal; *psp*, parasphenoid; *asp*, alisphenoid; *osp*, orbitosphenoid; *pro*, prootic; *spo*, sphenotic; *pto*, pterotic; *epo*, epiotic; *soc*, supraoccipital; *eoc*, exoccipital; *boc*, basioccipital.

Family 8. *Moringuidæ*.

Naked, cylindrical, with the tail much shorter than the trunk; vertical fins developed on the tail only; pectorals small or absent. Mouth small, with lateral cleft extending behind eye; maxillary articulating with ethmoid not far from end of snout; teeth uniserial; nostrils lateral; gill-openings separate; pharyngeal apertures of interbranchial clefts restricted, of cleft in front of first gill wide; pharyngeals oblong or ovate, covered with small teeth. Heart at some distance behind the gills. Frontals paired, anteriorly with moderately developed mucous channels; vomer ankylosed to ethmoid; parasphenoid meeting frontals in a long sutural union; a prominent otic bulla. Suspensorium vertical; palatopterygoid slender, almost vestigial. Neural arches with zygapophyses, without distinct spines; caudal vertebræ without lateral transverse processes; ribs and intermuscular bones feeble.

*Moringua*.Family 9. *Nemichthyidæ*.

Naked, very elongate, compressed; dorsal and anal long, confluent with the reduced caudal, or extending to the end of the long slender tail; vent not far behind gill-openings. Snout and lower jaw produced, slender; maxillary articulated to ethmoid far behind tip of snout; nostrils lateral; gill-openings wide, sometimes confluent below; pharyngeal apertures of branchial clefts wide. Frontals paired. Suspensorium vertical; palatopterygoid absent. Caudal vertebræ with long neural spines and without transverse processes.

Principal genera: *Spinivomer*, *Serrivomer* (*Gavialiceps*), *Stemonidium*, *Avocettina*, *Nemichthys*.

In the last three the teeth are small and numerous, regularly arranged in quincunx; the first two have a series of strong teeth on the vomer.

Family 10. *Cyemidæ*.

*Cyema atrum* has the jaws and dentition of *Nemichthys*, except that the maxillary is longer, extending backwards far behind the small eye; the suspensorium is directed obliquely backwards. The body is only moderately elongate, with the trunk and tail nearly equal in length; the dorsal and anal fins are opposed, separated only by a notch at the end of the tail; the vertebræ number about 80.



The suggestion that *Cyema* is a *Nemichthys* with regenerated tail cannot be entertained; the four specimens known are extremely similar and the posterior caudal vertebræ decrease in length backwards in a perfectly regular manner.

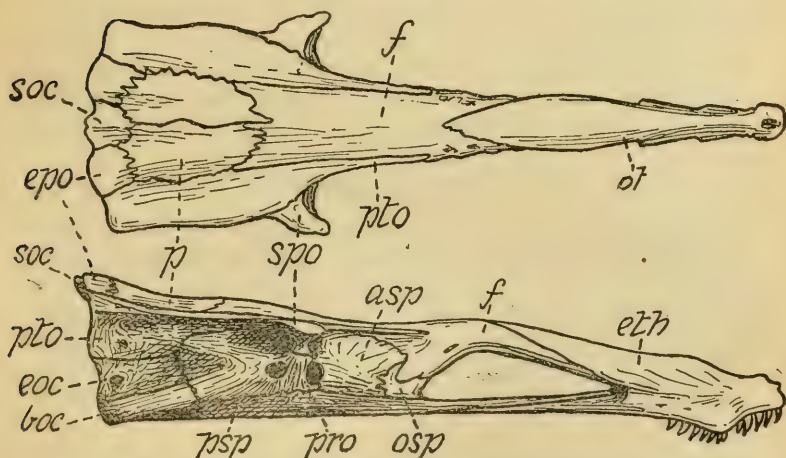
### Family 11. *Murænesocidæ*.

*Murænesox* is related to the Congridæ, but the maxillaries are articulated to the ethmoid at a considerable distance from the end of the somewhat produced snout, the ribs are rather strong, and the caudal vertebræ are formed as in the Anguillidæ, without lateral transverse processes. The jaws have strong anterior canines and the vomer is armed with a median series of large teeth.

### Family 12. Congridæ.

Dorsal and anal fins continuous with the reduced caudal; body naked; vent remote from head. Mouth with lateral cleft, not extending far behind eye; maxillary articulated

Fig. 2.



*Conger conger*. Skull from above and from the side.

Lettering as in fig. 1.

with ethmoid near end of snout; teeth conical, cardiform, or compressed, in bands or in one or more series, well developed

in jaws and on vomer. Nostrils lateral; gill-openings separate; pharyngeal apertures of branchial clefts wide; pharyngeals ovate or oblong, covered with small teeth. Frontals ankylosed to form a single bone; vomer ankylosed to ethmoid; orbitosphenoids small. Suspensorium vertical or directed obliquely forward; palato-ptyergoid an elongate lamina. 4 pectoral radials. Neural spines well developed; caudal and posterior præcaudal vertebræ with lateral transverse processes, in addition to hæmal arches or parapophyses; ribs and intermuscular bones feeble.

This large and varied family corresponds to the Leptocephalidæ, Murænesocidæ (except *Murænesox*), and Nettastomidæ of Jordan and Evermann.

Principal genera: *Heteroconger*, *Promyllantor*, *Congromuræna*, *Conger*, *Congrosoma*, *Uroconger*, *Coloconger*, *Neconger*, *Stilbiscus*, *Leptoconger*, *Gordüichthys*, *Hoplunnis*, *Oxyconger*, *Xenomystax*, *Nettastoma*, *Saurenehelys*, *Nettenchelys*, *Chlopsis*, *Venefica*, *Metopomycter*.

In this family there is a more or less prominent vertical ridge on the middle of each centrum and the parapophysis is more or less completely divided into two. *Echelion montium* (Hay, Bull. Amer. Mus. xix. 1903, p. 441, pl. xxxvii. figs. 2-6), from Mount Lebanon, described as an apparently diplospondylous eel, had vertebræ of this type.

*Derichthys serpentinus*, Gill, is said to have distinct præmaxillaries, but this requires confirmation, as in other characters it seems to be a member of the family Congridæ.

### Family 13. Echelidæ.

Differs from the Congridæ in the labial nostrils, the rather strong ribs and intermuscular bones, and the vestigial neural spines.

*Echelus*, *Ahlia*, *Myrophis*, *Paramyrus*, *Chilorhinus*, *Murænichthys*. *Eomyrus*, from the Upper Eocene of Belgium, also belongs to this family (Storms, Bull. Soc. Belge Géol. x. 1896, pp. 225-240, pls. v., vi.).

### Family 14. Ophichthyidæ.

Differs from the Congridæ in the absence of the caudal fin, the tip of the tail projecting beyond the dorsal and anal, the labial nostrils, and the vestigial neural spines.

*Sphagebranchus*, *Pisodontophis*, *Callechelys*, *Ophichthys*, *Brachysomophis*, &c.

Family 15. **Ilyophidæ.**

Dorsal and anal continuous with the reduced caudal; pectorals present; body scaly; vent remote from the head. Mouth terminal, with lateral cleft extending behind the eye; maxillary slender, articulated with ethmoid near end of snout; teeth conical, small and in narrow bands in the jaws, large and in a single series on the vomer; nostrils lateral; gill-openings separate; pharyngeal apertures of branchial clefts wide. Suspensorium probably directed somewhat obliquely backwards.

*Ilyophis brunneus*, Gilbert, may be related to the Anguillidæ on the one hand and the Synphobranchidæ on the other, but it seems still nearer to the Dysommidæ.

Family 16. **Dysommidæ.**

External characters, jaws, and dentition of the Ilyophidæ, except that the body is naked, the vent is not far behind the gill-openings, and the cleft of the mouth extends far behind the eye. Frontals ankylosed to form a single bone; suspensorium directed very obliquely backwards; palatopterygoid absent; vertebral column as in the Anguillidæ.

Two genera, *Dysomma*, with pectoral fins and the vent below the gill-openings, and *Dysommopsis*, without pectorals and with the vent further back, have been described by Alcock from the depths of the Indian Ocean.

Family 17. **Synphobranchidæ.**

External characters of the Ilyophidæ, except that the cleft of the mouth extends far behind the eye and the gill-openings are confluent; teeth small, conical, in narrow bands or in a single series in jaws and on vomer. Frontals united to form a single bone; suspensorium long, directed very obliquely backwards; palatopterygoid long, slender, almost vestigial. Vertebral column as in the Anguillidæ.

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L.—*A Revision of the South-American Characid Fishes of the Genera Chalceus, Pyrrhulina, Copeina, and Pogonocharax.* By C. TATE REGAN, M.A.

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THE four genera here dealt with form a natural group, differing from other Characidæ in the very large mesethmoid

and showing further agreement in their oblong or elongate form, rounded abdomen, flattish upper surface of the head, large scales, short dorsal and anal fins, &c.

I give a list of the specimens in the British Museum collection, considerably augmented in the last few years by gifts of examples from the Amazon (Herr J. Paul Arnold), Obidos (Herr A. Rachow), Manaus (E. Stanley Sutton, Esq.), and Colombia (Sir Bryan Leighton), and by the acquisition of a set from Professor Eigenmann's collection made in British Guiana.

### 1. CHALCEUS.

*Chalceus*, Cuv. Mém. Mus. Paris, iv. 1818, p. 454; Günth. Cat. Fish. v. p. 333 (1864).

*Plethodectes*, Cope, Proc. Amer. Phil. Soc. xi. 1871, p. 563.

*Pellegrinina*, Fowler, Proc. Acad. Philad. 1906, p. 442.

Body oblong, compressed. Scales large, unequal; lateral line present, running low. Mouth moderate, terminal; præmaxillary teeth triserial, the outer tricuspid, the inner pentacuspoid; maxillary toothed; mandibular teeth biserial, the outer tri- or pentacuspoid, the inner series conical, small, except for an enlarged median pair; palate toothless. Nostrils close together. Gill-membranes free. Dorsal and anal fins short; adipose fin present.

#### 1. *Chalceus macrolepidotus*.

*Chalceus macrolepidotus*, Cuv. Mém. Mus. Paris, iv. 1818, p. 454, pl. xxi. fig. 1; Günth. Cat. Fish. v. p. 333 (1864).

*Pellegrinina heterolepis*, Fowler, Proc. Acad. Philad. 1906, p. 442, fig.

Depth of body  $3\frac{1}{2}$  to 4 in the length, length of head  $3\frac{1}{4}$  to  $3\frac{3}{4}$ . Diameter of eye 3 to 4 in length of head, interorbital width 2 to  $2\frac{1}{2}$ . 20 or 21 scales in a longitudinal series from upper angle of gill-cleft to base of caudal, 37 in the lateral line. Dorsal 12; origin behind base of pelvics, equidistant from tip of snout and end of middle caudal rays. Anal 12.

Guiana.

- 1. 150 mm.
- 2-3. 110 mm.
- 4. 65 mm.

Essequibo.  
Brit. Guiana.  
Surinam.

Ehrhardt.  
Schomburgk.  
Kappler.

#### 2. *Chalceus erythrurus*.

*Plethodectes erythrurus*, Cope, Proc. Amer. Phil. Soc. xi. 1871, p. 563, fig.

Depth of body  $3\frac{2}{3}$  in the length, length of head  $3\frac{5}{6}$ .



Diameter of eye 4 in length of head, interorbital width  $2\frac{1}{2}$ . 18 or 19 scales from upper angle of gill opening to base of caudal fin, 33 or 34 in the lateral line. Dorsal 12; origin above base of pelvics, equidistant from tip of snout and end of scales on caudal. Anal 11.

Upper Amazon.

1. 170 mm.

R. Cupai.

Stevens.

Cope's type was a specimen of 65 mm. with the head  $\frac{1}{3}$  of the length, eye  $\frac{1}{3}$  and interorbital width  $\frac{2}{5}$  of the length of head, &c. He described the outer præmaxillary teeth as conical, and indeed they are less expanded than in *C. macrolepidotus*, but they have a pair of cusps.

## 2. PYRRHULINA.

*Pyrrhulina*, Cuv. & Val. Hist. Nat. Poiss. xix. 1846, p. 535; Günth. Cat. Fish. v. p. 286 (1864).

Body oblong or rather elongate, compressed. Scales large; no lateral line. Mouth moderate or small, terminal, with the lower jaw projecting; præmaxillary and mandibular teeth conical, biserial; palate toothless. Nostrils close together. Gill-membranes free. Dorsal and anal fins short; no adipose fin.

### *Synopsis of the Species.*

I. 26 or 27 scales in a longitudinal series; diameter of eye  $2\frac{2}{3}$  to  $3\frac{1}{3}$  in length of head, in specimens of 35 to 80 mm. . . . 1. *filamentosa*.

II. 20 to 25 scales in a longitudinal series; diameter of eye 3 to 4 in length of head, in specimens of 25 to 85 mm.

A. Body slender, the depth 5 in the length; caudal peduncle nearly as long as head; 22 scales in a longitudinal series.

2. *nattereri*.

B. Body deeper, the depth  $3\frac{1}{2}$  to  $4\frac{1}{2}$  in the length.

1. Caudal peduncle at least  $\frac{2}{3}$  length of head; 22 to 25 scales in a longitudinal series . . . . . 3. *semifasciata*.

2. Caudal peduncle at most  $\frac{2}{3}$  length of head.

Interorbital width 2 in length of head; 20 scales in a longitudinal series; depth of body  $3\frac{1}{2}$  in length . . . . . 4. *vittata*.

Interorbital width 2 to  $2\frac{1}{3}$  in length of head; 20 to 23 scales in a longitudinal series; depth of body  $3\frac{3}{4}$  to  $4\frac{1}{2}$  in length . . . . . 5. *australis*.

Interorbital width  $2\frac{1}{2}$  to 3 in length of head; 20 to 22 scales in a longitudinal series . . . . . 6. *brevis*.

### 1. *Pyrrhulina filamentosa*.

*Pyrrhulina filamentosa*, Cuv. & Val. Hist. Nat. Poiss. xix. 1846, p. 535, pl. 589; Günth. Cat. Fish. v. p. 286 (1864).

Depth of body  $4\frac{1}{4}$  to  $5\frac{1}{2}$  in the length, length of head 4 to  $4\frac{1}{4}$ . Caudal peduncle  $\frac{2}{3}$  to  $\frac{4}{5}$  length of head. Snout shorter than the diameter of eye, which is  $2\frac{2}{3}$  to  $3\frac{1}{3}$  in the length of head; interorbital width  $2\frac{1}{3}$  to  $2\frac{1}{2}$ . 26 or 27 scales in a longitudinal series. Dorsal 10; origin equidistant from middle or posterior part of operculum and base of caudal. Anal 11–12. Olivaceous; a blackish stripe round lower jaw to eye, continued as a more or less distinct brownish stripe from eye to operculum; a large black spot on dorsal fin.

Guiana.

1–2. 65–80 mm.	Essequibo.	Ehrhardt.
3. 50 mm.	Issorora, Brit. Guiana.	Eigenmann.
4–5. 35–40 mm.	Lama,        "       "	"

## 2. *Pyrrhulina nattereri*.

? *Holotaxis melanostomus*, Cope, Proc. Amer. Phil. Soc. xi. 1871, p. 563.

*Pyrrhulina nattereri*, Steind. Sitzungsab. Akad. Wien, lxxii. 1876, p. 13, pl. ii, fig. 5.

Depth of body 5 in the length, length of head  $4\frac{1}{2}$ . Caudal peduncle nearly as long as head. Snout somewhat shorter than diameter of eye, which is  $3\frac{1}{3}$  in the length of head; interorbital width  $2\frac{1}{3}$ . 22 scales in a longitudinal series. Dorsal 9–10, elevated in the male, nearly reaching caudal when laid back; origin equidistant from middle of operculum and base of caudal. Anal 10–11. Olivaceous; scales of back and sides dark-edged; a small pale blue spot with dark margin at the posterior end of each scale on the side; a dark stripe from upper part of eye round end of snout, another from eye round lower jaw, continued on body as a faint dusky band; a large blackish spot on middle of dorsal fin, with red band below it.

Amazon.

1. 40 mm.	Amazon.	Arnold.
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This specimen is undoubtedly *P. nattereri*; it agrees with the description of *H. melanostomus* in every way, except that the latter is said to have 25 scales, a number perhaps obtained by counting forward above the opercle or by including the scales on the caudal fin.

## 3. *Pyrrhulina semifasciata*.

? *Holotaxis læta*, Cope, Proc. Acad. Philad. 1871, p. 257.

*Pyrrhulina semifasciata*, Steind. Sitzungsab. Akad. Wien, lxxii. 1876, p. 7, pl. i. figs. 1, 2; Eigenm. & Eigenm. Proc. Calif. Acad. (2) ii. 1890, p. 110.

? *Pyrrhulina maxima*, Eigenm. & Eigenm. t. c. p. 111.

? *Pyrrhulina lata*, Fowler, Proc. Acad. Philad. 1906, p. 294, fig. 1.

Depth of body  $3\frac{1}{2}$  to  $4\frac{1}{2}$  in the length, length of head  $3\frac{3}{4}$  to  $4\frac{1}{2}$ . Caudal peduncle  $\frac{2}{3}$  to  $\frac{5}{8}$  the length of head. Snout as long as or shorter than diameter of eye, which is 3 to  $3\frac{3}{4}$  in the length of head; interorbital width  $2\frac{1}{4}$  to  $2\frac{2}{3}$ . 22 to 25 scales in a longitudinal series. Dorsal 10; origin equidistant from eye or postorbital part of head and base of caudal. Anal 10-12. Scales sometimes with pale bases and dark margins. A dark stripe from lower jaw through eye, ending on anterior part of body; sometimes a long dark median spot on back between head and dorsal fin and a smaller one just in front of dorsal fin; a blackish spot on dorsal fin.

Amazon; Guiana; Colombia.

1-4. 35-70 mm.	Nickafaroo, Brit. Guiana.	Eigenmann.
5-9. 45-55 mm.	Christiansburg, Brit. Guiana.	"
10-14. 40-85 mm.	Holmia, Brit. Guiana.	"
15-16. 45-55 mm.	Honda, Colombia.	Leighton.
17. 50 mm.	Bogota, "	Cutter.

In these specimens the dark stripe usually runs on only 2 to 4 scales of the body; in the larger ones it is continued backwards, as shown in Steindachner's figures; in the smaller fish the mid-dorsal spots are absent.

*P. lata* is evidently closely related to *P. semifasciata*, even if it be distinct. The saddle-shaped spot on the back would easily be formed by the increase in size of the two spots seen in *P. semifasciata*.

*P. maxima* is based on a single specimen, and as described seems to differ from *P. semifasciata* only in the fewer scales; but "the scales are partly lost, so an exact count is impossible."

#### 4. *Pyrrhulina vittata*, sp. n.

Depth of body  $3\frac{1}{2}$  in the length, length of head  $3\frac{1}{2}$ . Caudal peduncle  $\frac{2}{3}$  length of head. Diameter of eye 3 in the length of head, interorbital width 2. 20 scales in a longitudinal series. Dorsal 11; origin equidistant from præoperculum and base of caudal. Anal 11. A dark stripe from lower jaw through eye, ending in a spot just behind head; 3 blackish bars on body, the first above end of pectoral, the second running upwards from base of anal, the third in front of the caudal; a blackish spot on dorsal fin.

Amazon.

1. 28 mm. (type).

Obidos.

Rachow,

5. *Pyrrhulina australis*.

*Pyrrhulina australe*, Eigenm. & Kennedy, Proc. Acad. Philad. 1903, p. 508.

Depth of body  $3\frac{3}{4}$  to  $4\frac{1}{2}$  in the length, length of head  $3\frac{3}{4}$  to  $4\frac{1}{4}$ . Caudal peduncle  $\frac{1}{2}$  to  $\frac{2}{3}$  length of head. Snout shorter than diameter of eye, which is 3 in the length of head; interorbital width 2 to  $2\frac{1}{3}$ . 20 to 23 scales in a longitudinal series. Dorsal 10–11; origin equidistant from head and base of caudal or a little nearer to head. Anal 11–12. Olivaceous; a blackish stripe from lower jaw to eye, usually continued as a brownish stripe on postorbital part of head; a black spot on dorsal fin.

La Plata; Rio Grande do Sul.

1–3. 30–40 mm.	Colonia Risso, Upper Paraguay.	Borelli.
4–5. 30 mm.	Carandasinho, Matto Grosso.	"
6–11. 25–45 mm.	Corumba, " "	Moore.
12–14. 30–35 mm.	Descalvados, " "	Ternetz.
15–16. 25–30 mm.	Monte Sociedad, Chaco.	"
17. 25 mm.	R. Grande do Sul.	Von Ihering.

6. *Pyrrhulina brevis*.

*Pyrrhulina brevis*, Steind. Sitzungs. Akad. Wien, lxxii. 1876, p. 11, pl. i. figs. 3–4; Eigenm. & Eigenm. Proc. Calif. Acad. (2) ii. 1890, p. 111.

Depth of body nearly equal to length of head,  $3\frac{1}{2}$  to 4 in the length of the fish. Caudal peduncle  $\frac{1}{2}$  or  $\frac{2}{3}$  length of head. Snout nearly as long as or even a little longer than diameter of eye, which is  $3\frac{1}{2}$  to 4 in the length of head; interorbital width  $2\frac{1}{2}$  to 3. 20 to 22 scales in a longitudinal series. Dorsal 9–10, moderately elevated; origin equidistant from operculum and base of caudal, or a little nearer the former. Anal 11–12. Olivaceous; a dark stripe from eye round lower jaw; a dark spot on dorsal fin; pelvic and anal fins with narrow blackish edge.

Amazon.

1, 85 mm.	Mañaos,	Sutton.
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## 3. COPEINA.

*Copeina*, Fowler, Proc. Acad. Philad. 1906, p. 294.

Differs from *Pyrrhulina* in the uniserial præmaxillary teeth.



*Synopsis of the Species.*

I. Depth of body less than  $\frac{1}{4}$  of the length; caudal peduncle nearly as long as head; origin of dorsal fin well behind base of pelvics.

A. Origin of dorsal fin nearer to base of caudal than to head.  
1. *arnoldi*.

B. Origin of dorsal fin equidistant from head and base of caudal, or a little nearer head.

21 scales in a longitudinal series ..... 2. *callolepis*.  
23 or 24 scales in a longitudinal series ..... 3. *eigenmanni*.  
26 scales in a longitudinal series ..... 4. *carsevevniensis*.

II. Depth of body not less than  $\frac{1}{4}$  of the length; caudal peduncle considerably shorter than head.

Origin of dorsal fin a little behind base of pelvics .. 5. *guttata*.

Origin of dorsal fin above base of pelvics ..... 6. *argyrops*.

1. *Copeina arnoldi*, sp. n.

Depth of body  $4\frac{1}{2}$  to  $4\frac{3}{4}$  in the length, length of head  $4\frac{2}{3}$  to 5. Caudal peduncle nearly as long as head. Snout shorter than diameter of eye, which is  $3\frac{1}{3}$  in the length of head; interorbital width  $2\frac{1}{3}$ . 23 or 24 scales in a longitudinal series. Dorsal 10; origin nearer to base of caudal than to head. Anal 11. Olivaceous; a dark stripe from eye round lower jaw; a blackish spot on dorsal fin.

Amazon.

1-2. 30-40 mm. (types).

Amazon.

Arnold.

2. *Copeina callolepis*, sp. n.

*Pyrrhulina nattereri* (non Steind.), Eigenm. & Eigenm. Proc. Calif. Acad. (2) ii. 1890, p. 112.

Depth of body  $4\frac{1}{2}$  to 5 in the length, length of head  $4\frac{1}{2}$ . Caudal peduncle nearly as long as head. Snout shorter than diameter of eye, which is 3 in length of head; interorbital width  $2\frac{1}{3}$  to  $2\frac{1}{2}$ . 21 scales in a longitudinal series. Dorsal 10; origin equidistant from head and base of caudal, or slightly nearer the former. Anal 11. Olivaceous; a dark stripe from lower jaw to eye continued as a dusky band on lower part of body; a pale spot on each scale, except below the band; a black spot on the dorsal fin.

Amazon.

1-2. 35-40 mm. (types).

Amazon.

Arnold.

3. *Copeina eigenmanni*, sp. n.

Depth of body  $4\frac{1}{4}$  to 5 in the length, length of head 4 to  $4\frac{1}{2}$ .  
*Ann. & Mag. N. Hist.* Ser. 8. Vol. x. 27

Caudal peduncle nearly as long as head. Snout shorter than eye, the diameter of which is 3 to 4 in the length of head; interorbital width  $2\frac{1}{2}$ . 23 or 24 scales in a longitudinal series. Dorsal 10; origin equidistant from head and base of caudal, or nearer head. Anal 11-12, originating a little behind end of dorsal. Olivaceous; a dark stripe from lower jaw through eye to operculum; a blackish spot on dorsal fin.

Amazon; Guiana; Colombia.

1-2. 25 mm. (types).	Para.	Eigenmann.
3-9. 25 mm. "	R. Aruka, Brit. Guiana.	"
10. 27 mm. "	Lama, " "	"
11-12. 35-45 mm. "	Bogota.	Cutter.

In the smaller examples there is sometimes an indistinct dusky band on the anterior part of the body and an indication of a pale stripe above the dark one on the head. In the larger ones, from Bogota, a silvery stripe from eye to caudal fin separates a broad dark band below from the dark colour of the back.

#### 4. *Copeina carsevennensis*, sp. n.

Depth of body nearly equal to length of head,  $4\frac{1}{4}$  to  $4\frac{1}{2}$  in the length of the fish. Caudal peduncle nearly as long as head. Snout shorter than eye, the diameter of which is  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in the length of head; interorbital width  $2\frac{1}{3}$ . 26 scales in a longitudinal series. Dorsal 10; origin equidistant from head and base of caudal, or a little nearer head. Anal 11-12, commencing scarcely behind end of dorsal. Olivaceous; a dark stripe from lower jaw through eye to operculum; a black spot on dorsal fin.

French Guiana.

1-5. 25-33 mm. (types).	Carsevenne.	Paris Mus. (Coll. Geay).
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#### 5. *Copeina guttata*.

*Pyrrhulina guttata*, Steind. Sitzungs. Akad. Wien, lxxii. 1876, p. 15, pl. ii. fig. 6; Eigenm. & Eigenm. Proc. Calif. Acad. (2) ii. 1890, p. 112.

Depth of body  $3\frac{3}{4}$  to 4 in the length, length of head 4 to  $4\frac{1}{4}$ . Caudal peduncle much shorter than head. Diameter of eye  $3\frac{1}{2}$  in the length of head, interorbital width  $2\frac{1}{3}$  to  $2\frac{2}{5}$ . 23 or 24 scales in a longitudinal series. Dorsal 10; origin a little behind base of pelvics. Anal 12. A silvery spot at the base of each scale; a dark spot on dorsal fin.

R. Amazon.

Total length 70 mm.

6. *Copeina argyrops*.

*Pyrrhulina argyrops*, Cope, Proc. Amer. Phil. Soc. xvii. 1878, p. 694.  
*Copeina argyrops*, Fowler, Proc. Acad. Philad. 1906, p. 295, fig. 2.

Very similar to *C. guttata* in form, coloration, &c., but with the dorsal fin a little further forward, originating above base of pelvics.

R. Maranon, Peruvian Amazon.

## 4. POGONCHARAX.

*Pogonocharax*, Regan, Ann. & Mag. Nat. Hist. (7) xix. 1907, p. 261.

Differs from *Pyrrhulina* in the toothless mouth and the presence of two pairs of barbels, præmaxillary and maxillary.

1. *Pogonocharax rehi*.

Regan, *l. c.* fig.

Dorsal 8, above the anal. Anal 8. 25 scales in a longitudinal series. Maxillary barbel  $\frac{2}{3}$  as long as the fish.

Argentina.

1. 45 mm. (type).

Argentina.

Reh.

LI.—On a Collection of Small Mammals from the Tsin-ling Mountains, Central China, presented by Mr. G. Fenwick Owen to the National Museum. By OLDFIELD THOMAS.

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DURING the late summer of 1911 Mr. G. Fenwick Owen, to whom the National Museum already owed some valuable collections of mammals from French Gambia, made an exploring and collecting expedition into Central China, into Southern Shen-si and Kan-su, with the intention of exploring the mountain-ranges between those provinces and Eastern Tibet. Owing, however, to the breaking out of the recent revolution in China, Mr. Owen's party had to shorten their work and to come home through Tibet and Russia in Asia, by which route they were fortunately enabled to transport in safety such collections as they had made before the revolution broke out.

The small mammals, which Mr. Fenwick Owen has now presented to the British Museum, were all prepared by his

companion and interpreter, Dr. J. A. C. Smith, who had already accompanied Mr. Malcolm Anderson into this region, and had also made collections on his own account, so that both country and fauna were well known to him.

The collection consists of 68 specimens, belonging to 18 species, of which 7 are new, thus again showing the richness and diversity of the fauna of this wonderful region.

Of these by far the most striking is the new mole, *Scapanulus oweni*, representing a new genus more allied to the American moles than to any previously known in Asia. Other valuable accessions are the *Zapus*, the *Sicista*, and the new shrews of the new genera *Blarinella* and *Chodsigoa*.

Mr. Fenwick Owen and Dr. Smith are to be congratulated on the amount of novelties yielded by the collection, which forms a most valuable supplement to the series obtained by Mr. Anderson during the Duke of Bedford's Exploration of Eastern Asia.

1. *Scapanulus oweni*, gen. et sp. n.

♂. 59. 46 miles S.E. of Tao-chou, Kan-su. Alt. 10,000'.

♂. 72. 23 miles S.E. of Tao-chou. 9000'.

"In mossy undergrowth in fir-forest."—J. A. C. S.

SCAPANULUS, gen. nov. (*Talpidae*, subfam. *Scalopinæ*).

Manus broadly expanded, nearly as much so as in the true moles, more so than in *Scaptonyx*. Claws rather slender for a mole; those of hind foot thin, rather straight, except that of the hallux, which is curved. On both sides in both specimens the hallux is peculiarly twisted away from the other digits, but this may possibly be due to distortion in drying. Tail comparatively long and thickly haired. Skull about as in *Urotrichus*, the pterygoid region less inflated and with better developed pterygoids than in *Scapanus*. Tympanics incomplete. Interparietal broad, less tapering forwards than in *Urotrichus*.

Teeth  $\frac{9}{9} \times 2 = 36$ , these being apparently

$$\text{I. } \frac{2}{2}, \text{ C. } \frac{1}{1}, \text{ PM. } \frac{3}{3}, \text{ M. } \frac{3}{3}.$$

As to the individual homologies of the teeth, I would tentatively suggest the following as the complete formula of the permanent dentition:—

$$\text{I. } \frac{1.2.0}{1.2.0}, \text{ C. } \frac{1}{1}, \text{ PM. } \frac{1.0.3.4}{1.0.3.4}, \text{ M. } \frac{1.2.3}{1.2.3}.$$

In this the premolar formula is not very certain, since it



may possibly be 1.2.0.4, as in the *Urotrichus-Uropsilus* series of genera; but I am quite confident about the lower incisors, which are 1.2.0, as in *Desmana* and the American moles, as compared with 0.2.3 or 0.2.0 in *Urotrichus*, *Uropsilus*, and their allies.

The most salient points of the dentition are: (1) the total number of 9 above and below, elsewhere only found in *Neurotrichus*, and (2) the *Desmana*-like character of the lower incisors, which are subequal, strongly proclivous, the second equally with the first abutting upon and being worn down by the hinder surface of the large anterior upper incisors.

$I^1$  large, about as large proportionally as in *Scalops* and *Urotrichus*, therefore larger than in *Scapanus*, but very far from as large or as specialized as in *Desmana* and *Galemys*.  $I^2$  and  $p^1$  subequal, small, the canine between them rather larger, double-rooted.  $P^3$  of about the same length and twice the bulk of the canine;  $p^4$  about four times the bulk of  $p^3$ , with a well-marked internal cusp. Molars with their internal ledge subtrilobate, about as in *Scapanus*.

Type. *Scapanulus oweni*, sp. n.

Dividing, as I should, the family *Talpidae* into five sub-families—the *Desmaninae*, *Talpinae*, *Scalopinae*, *Condylurinae*, and *Uropsitinae*—this most interesting new genus falls obviously into the *Scalopinae*, within which it belongs rather to the Scalopine than the Urotrichine series of genera. But with its rather less modified manus and pterygoids and comparatively delicate skull it adds another to the links which bind these two series of genera to each other. From *Scaptonyx*, the only allied genus geographically near it, it is at once separable by its more modified manus, fewer teeth, much larger  $i^1$ , and its Desman-like lower incisors.

*Scapanulus oweni*, sp. n.

Bulk about half that of *Talpa europaea*. Colour of body exactly as in that animal, the lower surface almost imperceptibly lighter than the upper. Head rather paler. Hands pale brown above, with whitish edges. Feet brown proximally, white on the digits. Tail long, thick, well-haired, grey-brown with rather lighter tip.

Skull and teeth as described above.

Dimensions of the type (measured in flesh):—

Head and body 108 mm.; tail 38; hind foot 14.

Skull: greatest length 28.2; condylo-basal length 27.5;

greatest breadth 13; zygomatic breadth 10·6; interorbital breadth 5·5; palatal length 12·7; upper tooth-series 12·3; molars only 5·2.

*Hab.* as above.

*Type.* Adult male. B.M. no. 12. 8. 5. 2. Original number 72. Collected 31st October, 1911.

I have great pleasure in naming this most interesting new mole in honour of Mr. Fenwick Owen, to whose interest and kindness the Museum owes this valuable accession to its collections.

## 2. *Sorex sinalis*, sp. n.

♂. 8, 11, 12, 13, 16; ♀. 5, 7, 14. 45 miles S.E. of Feng-siang-fu, Shensi. 10,500'.

♀. 71. 17 miles S.E. of Tao-chou, Kan-su. 8900'.

"Rocky mossy mountain-top."—*J. A. C. S.*

A large plain-coloured species, with a long tail.

Size one of the largest of the genus. Fur about 5 mm. long on the back in summer specimens. General colour uniform greyish brown, with scarcely any tendency to a tricolor pattern; under surface drab-brown. Hands and feet brownish white. Tail long, slightly pencilled at the tip, brown above, lighter below.

Skull large, with long muzzle; brain-case not specially broadened.

Unicuspids slightly but evenly decreasing backwards. Concavities behind molars well marked.

Dimensions of the type:—

Head and body 70 mm.; tail 55; hind foot 14.

Skull: condylo-incisive length 21; condylo-basal length 20·3; greatest breadth 9·6; upper tooth-row 9·1; front of  $i^1$  to front of  $p^4$  4·2; front of  $p^4$  to back of  $m^2$  4·5; breadth between outer corners of  $m^1$  4·8.

*Hab.* 45 miles S.E. of Feng-siang-fu, Shen-si.

*Type.* Adult male. B.M. no. 12. 8. 5. 3. Original number 8. Collected 10th August, 1911.

This large but rather delicately built shrew has a decidedly longer skull than the other large Eastern plain-coloured species *S. unguiculatus* and *shinto*. It has nothing of the remarkable development of tooth-pigment characteristic of *S. daphænodon*.

## 3. *Sorex cansulus*, sp. n.

♂. 68. 15 miles S.E. of Tao-chou. 8500'.

♀. 56, 65. 46 miles S.E. of Tao-chou. 9800–10,000'.

*S. annexus-centralis* group, paler than the former and without the long muzzle of the latter.

Size as in *S. centralis*. Fur of back about 4 mm. in length. General colour above greyish brown, about as in *S. centralis*, much greyer than in *S. annexus*, which verges towards Prout's brown; sides in one specimen tinged with buffy, but no definite tricolor pattern present. No trace of a darker dorsal stripe. Under surface drab or broccoli-brown. Hands and feet brownish white. Tail dark brown above, lighter below.

Skull slightly longer than in *S. annexus*, its muzzle not specially lengthened as in *S. centralis*.

Dimensions of the type:—

Head and body 64 mm.; tail 38; hind foot 12.

Skull: condylo-incisive length 19.2; condylo-basal length 18.1; greatest breadth 9; upper tooth-row 8; front of  $i^1$  to front of  $p^4$  3.7; front of  $p^4$  to back of  $m^2$  4; breadth between outer corners of  $m^1$  4.6.

*Hab.* (of type). 46 miles S.E. of Tao-chou.

*Type.* Adult female. B.M. no. 12. 8. 5. 13. Original number 56. Collected 23rd September, 1911.

This species connects the Korean *S. annexus* with the Central-Asian *S. centralis*. It is much paler in colour than the former and has not the lengthened muzzle of the latter. While the skulls of all three are of about the same bulk, the muzzle, as measured from the front of  $p^4$  to the front of the large incisors, is in *S. annexus* 3.5 mm., *S. cansulus* 3.7 mm., and *S. centralis* 4.2 mm.

#### 4. *Sorex wardi*, Thos.

♂. 42, 43, 45; ♀. 46. 42 miles S.E. of Tao-chou. 10,000'.

♂. 58, 63, 64. 46 miles S.E. of Tao-chou. 10,000'.

♀. 29. 30 miles S.E. of Tao-chou. 9000'.

In summer pelage. The type, which is in winter pelage, came from 10 miles S. of Tao-chou.

#### 5. *Chodsigoa lamula*, sp. n.

♂. 66. 40 miles S.E. of Tao-chou. Alt. 9500'. 1st October, 1911. B.M. no. 12. 8. 5. 22. *Type.*

"Picked up on path in forest."—*J. A. C. S.*

Allied to *C. hypsibia*, but smaller.

General proportions and comparative length of tail about as in *C. hypsibia*, but size decidedly less. Fur close and soft; hairs of back about 3.5 mm. in length. General colour above

"mouse-grey," scarcely paler below. Hands and feet white, a slightly darker shade edging the latter externally. Tail greyish above, glossy whitish below.

Skull smaller than in *C. hypsibia*, its interorbital region even lower and flatter than in that species.

Dimensions of the type (measured in flesh) :—

Head and body 67 mm.; tail 54; hind foot 13.

Skull: condylo-basal length 18; condylo-incisive length 18·7; greatest breadth (c.) 9; upper tooth-series 8·0; combined length of  $p^4-m^2$  4·7.

*Hab. & Type* as above.

The species of *Chodsigoa* are all very closely allied, differing mainly by size and length of tail. This is the smallest and shortest-tailed as yet described.

#### 6. *Blarinella griselda*, sp. n.

♀. 41. 42 miles S.E. of Tao-chou. 10,000'. 17th September, 1911. B.M. no. 12. 8. 5. 23. *Type*.

"On mossy bank, in birch-wood."—*J. A. C. S.*

Smaller, greyer, and shorter-tailed than *B. quadraticauda*.

Size rather less than in *quadraticauda*. General colour above "mouse-grey," rather paler and more drabby below. Hands, feet, and tail all dull greyish, not dark brown as in the allied species; tail decidedly shorter than in that animal.

Skull rather smaller than in *quadraticauda*. Second upper unicuspid evenly intermediate in size between the first and third—in *quadraticauda* the second nearly equals the first and is conspicuously larger than the third.

Dimensions of the type (measured in flesh) :—

Head and body 68 mm.; tail 33; hind foot 11.

Skull: condylo-incisive length 20; condylo-basal length 18·6; greatest breadth 9·4; upper tooth-series 8·6; front of  $p^4$  to back of  $m^2$  4·5.

*Hab. & Type* as above.

This second species of the genus *Blarinella* is easily distinguishable from the Sze-chwan form by its smaller size, greyer colour, and shorter tail.

#### 7. *Mustela astuta*, M.-Edw.

♂. 40, 73. 25 and 40 miles S.E. of Tao-chou. 9000–9500'.

The marked narrowness of the frontal region distinguishes this weasel from the Tibetan *M. temon*, Hodgs., which it



resembles very closely in external characters. The type was obtained by David at Moupin.

The species had not previously been represented in the Museum collection.

8. *Eutamias asiaticus*, Pall.

♂. 62. 46 miles S.E. of Tao-chou. 9800'.

9. *Apodemus speciosus peninsulae*, Thos.

♂. 21, 22, 23, 24, 47, 53, 67; ♀. 25. 15 to 46 miles S.E. of Tao-chou. 8500-10,000'.

10. *Microtus malcolmi*, Thos.

♂. 10; ♀. 6, 9, 15. 45 miles S.E. of Feng-siang-fu, Shensi. 10,500'.

♀. 19, 49. 40 to 46 miles S.E. of Tao-chou, Kan-su. 9500'.

11. *Microtus oniscus*, Thos.

♂. 18, 50; ♀. 27, 31, 35, 36, 37, 38. 40 to 46 miles S.E. of Tao-chou, Kan-su. 9500'.

12. *Microtus (Caryomys) eva*, Thos.

♂. 28, 32, 54, 55; ♀. 17, 39, 57, 69, 70. 17 to 46 miles S.E. of Tao-chou. 8900-9500'.

13. *Myospalax smithii*, Thos.

♀ (immature). 44. 40 miles S.E. of Tao-chou. 9000'.

The second specimen known of this species. Though immature, it already shows evidence of the cranial and dental characters distinguishing *M. smithii* from *M. cansus*.

14. *Sicista concolor*, Büchn.

♀. 30. 35 miles S.E. of Tao-chou. 9000'.

♀. 33. 44 miles S.E. of Tao-chou. 10,000'.

The type locality of this species is the Alps of Si-ning, also in the province of Kan-su. No example of it had hitherto been in the Museum collection.

15. *Zapus (Eozapus) setchuanus vicinus*, subsp. n.

♂. 61; ♀. 52 to 60. 46 miles S.E. of Tao-chou, Kan-su. 9800-10,000'.

Similar to the Sze-chwan form in essential characters, but with longer tail, entirely white belly without central line (one specimen with a few pale buffy hairs along the mesial line of the belly), and with the tail usually black above to the tip.

Dimensions of the type (measured in flesh):—

Head and body 78 mm.; tail 144; hind foot 28; ear 15.

Skull: greatest length 23.2; condylo-incisive length 20; zygomatic breadth 12.7; nasals 9; interorbital breadth 4.2; palatilar length 8.7; palatal foramina 4.6; upper tooth-series 3.6.

*Hab.* as above.

*Type.* Adult female. B.M. no. 12. 8. 5. 62. Original number 52. Collected 22nd September, 1911.

These are the first specimens of the Asiatic *Zapus* received by the British Museum, and, so far as I know, the first that have been obtained since the Paris Museum received the examples from Sze-chwan described by M. Pousargues. They are therefore a most acceptable addition to the Museum collections.

The Kan-su form is evidently closely allied to that from Sze-chwan, but has a longer tail (126, 137, and 144 mm. in three specimens as compared with 95, 103, and 120) and is practically without the ventral stripe characteristic of the latter. One specimen (no. 60) has a few of the mesial hairs of the abdomen washed with buffy, and this indicates the affinity of the two forms. In a similar way one specimen (no. 61) out of three has a white tail-pencil, like all three of the true *setchuanus*.

16. *Ochotona syrinæ*, Thos.

♂. 34. 42 miles S.E. of Tao-chou, Kan-su. 12,000'.

The typical specimens were obtained at 10,600' on Mount Tai-pei-san, some 200 miles further east on the same mountain-chain.

17. *Ochotona cansa*, Lyon.

♂. 48, 51; ♀. 20. 40 to 46 miles S.E. of Tao-chou. 9500-10,000'.

These specimens are slightly darker in colour than examples from nearer Tao-chou, the type locality, and are therefore to

some extent intermediates between the true *cansa* and the subspecies next following.

18. *Ochotona cansa morosa*, subsp. n.

♀. 4. Tai-pai-san, 45 miles S.E. of Feng-siang-fu, Shen-si. 10,500'. 4th August, 1911. B.M. no. 12.8.5.68.  
*Type.*

Size slightly greater than in typical *cansa*. Colour darker, the hairs of the back more heavily blackened terminally. Under surface with all the hairs broadly washed with dark buffy, instead of, as in true *cansa*, only those of the middle line being so coloured, the sides of the belly being whitish. Hands and feet darker and more uniformly buffy above and more blackish below, the whitish fringes on either side of the feet, so marked in *cansa*, less developed and dull buffy in colour, so that practically the whole of the sole appears sooty brown.

Skull with rather more strongly convex frontal outline, broader interorbital space, larger brain-case, and broader palatal bridge than in any of the specimens of true *cansa*. In the type the projecting point representing the posterior part of the septum of the palatal foramina is more developed than usual, but this may be an individual peculiarity.

Dimensions of the type:—

Head and body 149 mm.; tail 8; hind foot 27; ear 18.

Skull: greatest length 36; condylo-incisive length 34.3; zygomatic breadth 18; nasals 11.2 × 4.4; interorbital breadth 4.1; breadth of brain-case 14.2; palatal bridge 2.6; upper tooth-series (alveoli) 6.7.

*Hab. & Type* as above.

In its dull colour this Pika has some resemblance to the *O. tibetana* of Sze-chwan, but is smaller, with larger bullæ and a more bowed frontal outline. Much more material is needed before the true relationship to each other of these allied forms of *Ochotona* can be clearly understood.

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LII.—*New Bats and Rodents from S. America.*

By OLDFIELD THOMAS.

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*Chæronycteris inca*, sp. n.

Nearly allied to *Ch. minor*, but the premolars shorter (horizontally) and the molars longer.

Fur of back about 6 mm. in length. General colour above of the usual dark brown, the bases of the hairs lighter, their tips blackish brown. Interfemoral membrane broad.

Skull rather larger and broader than in *Ch. minor*. Upper premolars shorter, less excessively compressed laterally. Two anterior molars longer, narrower proportionally, the posterior lobe particularly elongate, and with a well-marked postero-external cusp, each of the teeth showing three distinct cusps when viewed from the side. Last molar and lower teeth about as in *Ch. minor*.

Dimensions of the type :—

Forearm 33 mm.

Head and body 62; tail 8; lower leg and foot 21; calcar 6.5.

Skull: greatest breadth 8.5; interorbital breadth 4; front of canine to back of  $m^3$  7.8; length of  $p^3$  0.8,  $p^4$  0.9,  $m^1$  1.1,  $m^2$  1.1,  $p_4$  0.9,  $m_1$  1.0.

*Hab.* Yahuar Mayo, S.E. Peru. Alt. 1200'.

*Type.* Adult male. B.M. no. 12. 9. 5. 2. Original number 709. Collected 7th February, 1912, by H. and C. Watkins. One specimen.

Taking as representing Peters's Surinam *Ch. minor* the skull from the Cuparé River, Lower Tapajoz, so determined by Dobson (and there is a very strong Guianan character in the fauna of that part of the Amazon), the present bat from Peru differs in the proportional size of its teeth, but is otherwise closely similar to it. The Trinidad bat described by Allen and Chapman as *Ch. intermedia* is very probably the same as *Ch. minor*, as those authors were deceived by Peters's impossible measurement of 11 mm. for the calcar, an organ drawn as about 5 mm. long in the more recently published plate of the latter species (*Chiropt. Mus. Berol. pl. viii. a*).

### SCLERONYCTERIS, g. n. (*Glossophaginae*).

Like *Chæronycteris*, but molars and premolars more normal in structure.

External characters, general shape of skull\*, and dental formula all as in *Chæronycteris*. Zygomata not ossified. Chin unusually prominent, projecting both forwards and downwards. Interfemoral membrane broad.

*Upper teeth.*—Incisors comparatively large, the space between the inner pair not greater than the diameter of one of

\* The only skull is imperfect in the pterygoid region, so that the relationship to *Hylonycteris* cannot be stated. That genus agrees with *Chæronycteris* in its dental characters.



these teeth. Outer pair slightly larger than inner. Premolars normal in shape and size, not of the peculiar narrow elongate shape of those of *Chæronycteris*, but evenly oval in outline, each with one main cusp and without anterior or posterior secondary cusps; the anterior about two-thirds the size of the posterior. Molars broader than in the allied genus, their outer border straight, inner evenly convex; the hinder of the two main cusps, which are seen in lateral view, pushed inwards by an external broadening tending in the direction of the usual **W**-shaped structure of ordinary Glossophagine bats; but the anterior main cusp absolutely at the external edge of the tooth.

*Lower teeth*.—Incisors absent. Canines with well-marked posterior basal ledge. Premolars quite normal in shape, elongate oval in outline, increasing slightly in size from before backwards, nearly touching one another, therefore very different from the abnormal linear widely separated lower premolars of *Chæronycteris*, the anterior of which is the longest of the three. Lower molars nearly oval in outline, with something of the normal triangle in front and a broad deeply concave talon behind.

*Type*:—

*Scleronycteris ega*, sp. n.

General external characters as in *Chæronycteris minor*. Colour above Prout's brown, paler at bases of hairs, blackish at tip. Under surface rather lighter, except on the chin and interramia, where the colour is as dark as on the back. Palate-ridges three undivided and five divided. Tail present, its tip appearing on the upper surface of the membrane.

Dimensions of the type (measured in skin):—

Forearm 35 mm.

Head and body 57; tail 6; third finger, metacarpus 34, first phalanx 14, second phalanx 18; lower leg and hind foot (c. u.) 20; calcar 7.

Skull: greatest length (c.) 22; breadth of brain-case 9; front of canine to back of  $m^3$  7·4, greatest breadth between outer corners of  $m^2$  4·8; horizontal length of  $p^1$  0·9,  $p_1$  0·7,  $p_4$  1·0.

*Hab.* Ega, Amazons.

*Type.* Adult female. B.M. no. 7. 1. 1. 671. Original number 171. Tomes's number 212 *a*. Collected by H. W. Bates. From the Tomes Collection.

The type specimen has only recently had its skull extracted, so that its peculiar characters have not hitherto been observed. It is a most interesting form, as tending to

connect the aberrant *Chæronycteris* and *Hylonycteris* with the more normal-toothed members of the *Glossophaginæ*.

*Phyllotis magister*, sp. n.

General characters of *Ph. darwini*; size greater than in any other species of the genus.

Size conspicuously greater than in *Ph. darwini*. Fur of medium length and thickness. General colour above grizzled drabby grey, with slight buffy suffusion. Under surface dull creamy whitish, the bases of the hairs slaty. Ears large, as in the allied species; pale brown. Hands and feet large and heavy, their upper surfaces white. Tail long, well haired, blackish brown above, white below.

Skull as in *darwini*, but conspicuously larger throughout. Supraorbital edges not very sharply ridged.

Dimensions of the type, measured in the flesh:—

Head and body 152 mm.; tail 158; hind foot 32; ear 29.

Skull: greatest length 36·8; condylo-incisive length 34·2; zygomatic breadth 18·5; nasals 15·3; interorbital breadth 4·5; palatilar length 16·6; palatal foramina 9; upper molar series 6.

*Hab.* Arequipa, Peru. Alt. 2300 m.

*Type.* Adult male. B.M. no. 0.10.1.31. Original number 997. Collected 29th March, 1900, by Perry O. Simons. Presented by Oldfield Thomas.

This fine species is represented by a single specimen caught at the same place as a number of examples representing the northern form of *Ph. darwini*, a species in which the head and body length rarely exceeds 125 mm. and the skull length 33 mm. Its large molars and heavy rat-like feet also considerably surpass those of that animal.

*Phyllotis darwini posticalis*, subsp. n.

Proportions about as in true *darwini*. Fur very long, summer specimens with the wool-hair of the back very thick, about 15 mm. in length. General colour dark, little buffy, about as in typical Chilean *darwini* or in *lutescens*, therefore very different from the paler and more buffy forms inhabiting Southern Peru and the highlands of Bolivia. Tail rather longer than head and body, thickly hairy, the hairs practically hiding the scales, blackish above, sharply contrasted white below.

Skull as in true *darwini*, the teeth slightly larger.

Dimensions of two specimens, measured in flesh ; the first the type :—

Head and body 117 and 125 mm.; tail 122 and 135 ; hind foot 25 and 30 ; ear 27 and 26.

Skull of type : greatest length 30·7 ; condylo-incisive length 28·1 ; interorbital breadth 4 ; palatilar length 13·6 ; palatal foramina 7·2 ; upper molar series 5·3.

*Hab.* Galéra, W. of Oroya, Department of Junin, Peru. Alt. 4800 m.

*Type.* Adult female. B.M. no. 0.7.7.38. Original number 870. Collected 26th February, 1900, by P. O. Simons. Presented by Oldfield Thomas.

This is a dark well-haired mountain race of *Ph. darwini*, a widely spread species which ranges over the whole Andean area from Central Peru at least as far south as Santiago and Valparaiso in Chili, whence the Museum owes a good series from our generous correspondent Mr. J. A. Wolffsohn. By its dark colour it resembles the southern forms and differs from the other Peruvian and Bolivian representatives of *darwini*, which are pale and may mostly be referred to the following subspecies.

*Phyllotis darwini limatus*, subsp. n.

A pale race of *Ph. darwini*.

Size as in true *darwini*. Fur fine and soft. General colour pale greyish drab with a variable suffusion of buffy ; the sides especially buffy. Face clearer grey. Under surface dull creamy white. Ears large, pale brown. Hands and feet white. Tail not very heavily haired, brown above and white below, some specimens with an all-white tail-tip.

Skull as in true *darwini*.

Dimensions of the type (measured in flesh) :—

Head and body 115 mm. ; tail 150 (generally 130–135) ; hind foot 25 ; ear 28.

Skull : greatest length 31·4 ; condylo-incisive length 29·2 ; zygomatic breadth 16 ; interorbital breadth 4·4 ; upper molar series 4·8.

*Hab.* Chosica, near Lima, Peru. Alt. 850 m.

*Type.* Old male. B.M. no. 0.5.7.43. Original number 820. Collected 29th January, 1900, by Perry O. Simons. Presented by Oldfield Thomas.

This northern representative of *Ph. darwini* is paler and has a longer tail than the typical Chilian form. Specimens referable to it are in the Museum from various parts of the

highlands of Peru and Bolivia, including Caylloma, Arequipa, La Paz, &c. Further eastwards it probably grades into the form I named *wolffsohni*, which has, however, a rather differently shaped skull.

*Phyllotis darwini tucumanus*, subsp. n.

Proportions as in *darwini*. Colour dark. Nasals narrow. Size about as in true *darwini*. Fur long and fine. General colour dark, about as in *Ph. lutescens*. Under surface dull soiled greyish buffy, less white than in most of the races of *darwini*. Ears not very large. Hands and feet white. Tail rather longer than head and body, well haired, blackish above, white below.

Skull slightly smaller than that of true *darwini*, rather larger than that of *lutescens*. Nasals comparatively narrow, tapering backwards to a fine point. Interorbital region narrow, its edges less sharply angular than usual.

Dimensions of the type (measured in flesh):—

Head and body 107 mm.; tail ("two or three vertebræ lost") 110; hind foot 24; ear 22.

Skull: greatest length 31; condylo-incisive length 29·2; zygomatic breadth 15·8; nasals 13·5; interorbital breadth 4; palatilar length 14·5; palatal foramina 7·8; upper molar series 5·2.

*Hab.* Cumbre de Mala-mala, Sierra de Tucuman. Alt. 3300 m.

*Type.* Adult female. B.M. no. 4.10.2.6. Original number 3027. Collected 10th April, 1904, by E. Dinelli. Presented by Oldfield Thomas. Two specimens.

The skull of this animal is somewhat intermediate between that of *Ph. darwini* and *Ph. lutescens*, but I consider it provisionally as being more allied to the former. No species of this group have been previously recorded from anywhere near Tucuman.

*Phyllotis darwini vaccarum*, subsp. n.

A mountain race of *Ph. darwini*, with long hair and yellowish rump.

Size larger than in true *darwini* of the Central Chilian lowlands. Fur very long; hairs of back about 15 mm. in length. General colour paler than in true *darwini*, the upper surface suffused with buffy, especially on the rump, which is strong clear buffy. Face greyer. Under surface of the usual dull greyish white. Hands and feet white. Tail heavily haired, dark brown above, white below.



Skull longer than in any of the available specimens of true *darwini*, its interorbital region narrow, sharply edged, concave mesially.

Dimensions of the type (measured in flesh) :—

Head and body 130 mm.; tail 140; hind foot 28; ear 27.

Skull: greatest length 34; condylo-incisive length 31.7; zygomatic breadth 17.5; nasals 13.7; interorbital breadth 4; palatilar length 16.2; palatal foramina 8.4; upper molar series 5.8.

*Hab.* Las Vacas, Argentine slope of Cordillera opposite Mendoza. Alt. 2500 m.

*Type.* Old male. B.M. no. 2.2.5.51. Collected 15th November, 1901, by P. O. Simons. Presented by Oldfield Thomas.

This *Phyllotis*, found at the well-known station of Las Vacas, on the Andean route between Mendoza and Santiago, differs from the true *Ph. darwini* of the Chilean plains by its rather larger size, longer skull, sharply edged interorbital region, long fur, and buffy-coloured rump. It was also obtained by Philip Gosse at Puente del Inca, about 9000', but there is no evidence as to whether these animals are able to surmount the Andean chain (altitude of pass 12,800') or whether the eastern and western races are now completely isolated.

None of Philippi's numerous species of "*Mus*" that are referable to *Phyllotis darwini* are inhabitants of the high Andes.

### *Phyllotis andium*, sp. n.

Like *Ph. haggardi*, but tail much longer.

Size and general characters as in *haggardi*. Colour a little darker grey on the average, but the difference is neither great nor constant. Under surface dull greyish white slightly tinged with buffy. Ears not immensely large, greyish brown. Hands and feet white. Tail considerably and uniformly longer than in *haggardi*, brown above, white below.

Skull slightly larger and heavier than in *haggardi*, smaller than that of *darwini*, with which it agrees in general proportions.

Dimensions of the type (measured in flesh) :—

Head and body 115 mm.; tail 119; hind foot 25; ear 21.

Skull: greatest length 28.7; condylo-incisive length 26.8;

zygomatic breadth 15·2; nasals 11·3; interorbital breadth 4·3; palatilar length 13·2; palatal foramina 7; upper molar series 4·4.

*Hab.* Ecuador and Peru, along the Andean chain. Type from Cañar, Ecuador. Alt. 2600 m.

*Type.* Adult male. B.M. no. 99.9.9.68. Original number 267. Collected 18th April, 1899, by P. O. Simons. Presented by Oldfield Thomas.

The numerous examples of this *Phyllotis* obtained by Mr. Simons in the mountains of Ecuador and Peru have been hitherto looked upon as referable to *Ph. haggardi*, but additional specimens of the latter, received since its first description, show that it always has a comparatively short tail (85–90 mm.), while that of *Ph. andium* is rarely less than 115 mm. in length.

*Euneomys mordax*, sp. n.

A large heavily built greyish species, with normal-sized claws.

Size large, much larger than in the southern species *E. chinchilloides* and *petersoni*, more as in *E. fossor*. Fur long, thick, and woolly; hairs of back about 12–13 mm. in length. General colour dull greyish, too much faded in the type for exact description. Under surface lighter, not sharply defined, the hairs broadly washed with cream-buff. Ears of medium length, well-haired, the proectote blackish. Hands and feet dull greyish white above; fore claws of normal length, not elongated as in *E. fossor*. Tail thickly haired, greyish white with an indistinct darker line above.

Skull stout and heavily built, very like that of *E. fossor* and quite unlike that of the comparatively delicate *E. chinchilloides*. The supraorbital edges are, however, less sharply angular than in *E. fossor*, the muzzle and palatal foramina are shorter, and the teeth are smaller. Incisors very broad and heavy, strongly grooved.

Dimensions of the type (measured on the dry skin):—

Head and body (no doubt stretched) 147; tail (vertebræ dried in) 78; hind foot 28.

Skull (old, with worn teeth): condylo-incisive length 31; zygomatic breadth 20; interorbital breadth 4·7; breadth of brain-case 16; palatilar length 15·7; diastema 9; palatal foramina 7·6; upper molar series 6·1.

*Hab.* Fort San Rafael, Province of Mendoza.

*Type.* Old female. B.M. no. 55.12.24.199. Collected by Mr. T. Bridges.

In general proportions of body and skull this species resembles the Salta *E. fossor*, but is distinguished by its normal-sized claws, that animal having them elongated as in the subgenus *Chelemys*.

*Reithrodon cuniculoides flammearum*, subsp. n.

A large pale race of *R. cuniculoides*.

Size comparatively large, larger than in any other member of the genus. General colour pale, as in the typical race, much paler than in the inland forms *hatcheri* and *obscurus*. Posterior back suffused with buffy. Sides with the buffy wash at a maximum, the flanks and under surface bright "buff." Feet and tail heavily haired, the latter with a well-defined dark line along its upper surface.

Skull longer and more bowed than in the allied forms, so that the height is markedly greater.

Dimensions of the type (measured in the flesh):—

Head and body 169 mm.; tail 100; hind foot (s. u.) 34; ear 18.

Skull: greatest length 37.4; condylo-incisive length 34.8; zygomatic breadth 21; nasals 16.7; interorbital breadth 4.4; height from anterior base of  $m^3$  12.3; palatilar length 19; palatal foramina 11; upper molar series 6.4.

*Hab.* Tierra del Fuego. Type from Spring-hill, in the north of the island.

*Type.* Adult male. B.M. no. 9.9.10.1. Original number 357. Collected 15th June, 1909, by Dr. W. H. France, and presented through Mr. J. A. Wolffsohn, of Valparaiso.

The Tierra del Fuego *Reithrodon* seems to be rather larger than the typical form of Eastern Patagonia and is paler coloured than the two inland races described by Dr. Allen, *R. c. obscurus* of Punta Arenas\* and *R. hatcheri* of the Cordilleras farther north. How these two latter differ from each other is not clear, as each is simply diagnosed as being darker than *R. cuniculoides*. Dr. Allen has given the skull-length of a series of three *cuniculoides* as 33–35 mm., while the type skull of *hatcheri* is 35.7 in length. The Tierra del Fuego animal, with a skull-length of 37.4, is therefore markedly larger than either.

\* Probably *pachycephalus*, Philippi, 1900, based on a young specimen: cf. Wolffsohn, Bol. Mus. Chile, ii. p. 101 (1910).

LIIL.—*New Land and Freshwater Shells collected by Dr. J. Elbert in the Malay Archipelago.* By Dr. F. HAAS, Frankfurt-a.-M.

THE collection upon which the present paper is based was made by Dr. J. Elbert in the islands of South Celebes, Moena, Boeton, Kabaëna, Lombok, Soembawa, Flores, and Wetar. It contained a considerable number of new species and subspecies, which are described below. The types are in the Senckenberg Museum, Frankfurt-a.-M.

(1) *Xesta everetti elberti*, subsp. n.

Distinguished from typical *X. everetti* by its more conic form, more convex whorls, purple epidermis, and more opened umbilicus.

Diam. maj. 47, diam. min. 40 mm.; alt. 44 mm.

*Type locality.* Tongkok, Soembawa.

Specimen examined 1.

(2) *Hemiplecta (Rhysota) rugulosa*, sp. n.

Shell perforate, depressed conic, rather solid, striulate, with faint spiral lines and numerous elevated regular rugæ; somewhat shining, yellowish to brown, with a light peripheral and a dark subperipheral band; whorls  $5\frac{3}{4}$ , regularly increasing, the upper ones somewhat flattened, only with marked oblique rugæ, the lower ones more convex, with less marked oblique, and faint, somewhat undulating spiral lines; last whorl very broad, not deflexed anteriorly; suture impressed, submargined; aperture oblique, ovate-lunate; peristome sharp, not expanded, columellar margin reflexed above the umbilicus.

Diam. maj. 49, diam. min. 41 mm.; alt. 35 mm.

*Type locality.* Mengkoka, S.E. Celebes.

Specimens examined 8.

(3) *Xesta rugosissima wetarana*, subsp. n.

This local form differs from typical *X. rugosissima* by its somewhat lower spire, more convex whorls, and by not being carinate at the periphery of the last whorl.

Diam. maj. 29, diam. min. 24 mm.; alt. 19 mm.

*Type locality.* Tihoe, Wetar; another specimen from Ilwaki, Wetar.

Specimens examined 2.



(4) *Hemiplecta rasori*, sp. n.

Shell perforate, thin, diaphanous, densely and obliquely striate above, with a few faint spiral striæ, greyish brown, slightly striulate and shining below; spire low, conically globose, suture faint, appressed; whorls 5, rapidly increasing, the apical ones polished, the following ones flattened and scarcely striate, the last convex, densely striate, with an indistinct darker suprapertural band, not descending anteriorly; aperture oblique, ovate; peristome faint, not expanded, columellar margin reflexed above the umbilicus.

Diam. maj. 39, diam. min. 32 mm.; alt. 24 mm.

*Type locality.* Raha, island of Moena, off S.E. Celebes.

Specimen examined 1.

(5) *Hemiplecta demmeri*, sp. n.

Shell narrowly perforate, diaphanous, minutely and obliquely striate above, almost polished and shining below, covered with a very subtile green epidermis; spire depressed conic, apex rather well marked; whorls  $5\frac{1}{2}$ , regularly increasing, the upper ones somewhat flattened, the last very convex, not descending anteriorly; suture well impressed; aperture oblique, ovate; peristome not thickened nor expanded, columellar margin reflexed above the umbilicus.

Diam. maj. 33, diam. min. 27 mm.; alt. 22 mm.

*Type locality.* Tongkok, Soembawa; another specimen from Dompoe Plain, Soembawa.

Specimens examined 2.

(6) *Nanina trauti*, sp. n.

Shell perforate, rather solid, densely and obliquely striate above, with a few faint spiral striæ, light chestnut, slightly striulate and shining below, umbilicus dark chestnut; spire depressed conic, apex distinctly marked; whorls  $6\frac{1}{2}$ , the upper ones flattened and rather polished; the last scarcely deflexed anteriorly, convex, very striate, with a white peripheral band and a narrow dark chestnut one below it; suture faint, appressed; aperture narrow, ovate, peristome not thickened nor expanded, columellar margin partly covering the umbilicus.

Diam. maj. 31, diam. min. 26 mm.; alt. 20 mm.

*Type locality.* Bae-bae, Boeton, off S.E. Celebes.

Specimens examined 2.

(7) *Nanina butonensis hageni*, subsp. n.

Distinguished from typical *N. butonensis* by its higher spire, more convex whorls, chestnut-coloured umbilicus, and by the distinctly marked black peripheral band on the last whorl.

Diam. maj. 33, diam. min. 28 mm.; alt. 22 mm.

*Type locality.* Baoe-baœ, Boeton.

Specimens examined 3.

(8) *Nanina butonensis rarimaculata*, subsp. n.

Nearly related to typical *N. butonensis*, but somewhat larger, with two peripheral bands on the last whorl which are not connected at the aperture, and the last whorl above the upper band densely spotted with black; umbilicus dark.

Diam. maj. 36, diam. min. 30 mm.; alt. 21 mm.

*Type locality.* Lipoemangaoe, S.E. Boeton.

Specimens examined 4.

(9) *Everettia iridescens*, sp. n.

Shell small, moderately umbilicated, thin, corneous, shining and iridescent, very minutely striate above and below; spire much depressed, apex blunt, suture rather deep; whorls  $5\frac{1}{2}$ , rounded at the periphery, somewhat flattened above and below, regularly increasing; last whorl not descending anteriorly; aperture oblique, lunate; peristome thin, not thickened nor expanded; columellar margin somewhat reflexed upon the umbilicus.

Diam. maj. 8.5, diam. min. 7.5 mm.; alt. 4 mm.

*Type locality.* Swela, island of Lombok.

Specimens examined 2.

(10) *Trochomorpha (Videna) sterna*, sp. n.

Shell widely umbilicated, acutely keeled, thin, minutely and regularly striate above and below, pale corneous, with a dark chestnut, narrow band both above and below the keel; spire depressed, apex obtuse; whorls  $5\frac{1}{2}$ , regularly increasing, rather flattened below, the last obtusely angulated round the deep umbilicus, not descending anteriorly; suture very faint, appressed; peristome thin, columellar margin not reflexed.

Diam. maj. 15.5, diam. min. 13.3 mm.; alt. 5.5 mm.

*Type locality.* Tihoe, island of Wetar.

Specimen examined 1.

(11) *Trochomorpha (Videna) gründleri*, sp. n.

Shell widely umbilicated, acutely keeled, thin, minutely and densely striated above and below, the striae decussated below by faint undulated spiral lines; pale corneous, with a broad chestnut band both above and below the keel, shining; spire rather depressed, apex obtuse but distinctly marked; whorls  $5\frac{1}{2}$ , regularly increasing, the last obtusely angulated round the umbilicus, not descending anteriorly; suture faint, somewhat appressed; peristome thin, columellar margin not reflexed.

Diam. maj. 11, diam. min. 10 mm.; alt. 5 mm.

*Type locality.* Swela, island of Lombok; some more specimens from Sadjang, island of Lombok.

Specimens examined 6.

(12) *Chloritis planorbina*, sp. n.

Shell discoid, widely umbilicated, thin, brownish corneous, with a slight trace of a darker band near the suture, paler below, finely striated; spire somewhat impressed; whorls  $4\frac{1}{2}$ , the first ones increasing regularly, the last almost suddenly, slightly dilated towards the aperture, descending distinctly in front; aperture somewhat oblique, subovate; peristome thin, slightly reflexed, reddish, whitish at the columellar margin; the latter slightly overhanging the umbilicus.

Diam. maj. 24, diam. min. 19.5 mm.; alt. 11.5 mm.

*Type locality.* Roembia, S.E. Celebes.

Specimens examined 2.

(13) *Amphidromus wetaranus*, sp. n.

Shell oblong-conic, sinistral, nearly imperforate, solid; whorls  $6\frac{1}{2}$ , rather convex, pale yellow, with oblique greyish-purple stripes showing a tendency to break up and to form spiral bands; apex obtuse, dark brown; aperture very high; peristome slightly expanded and reflexed, whitish and shining inside.

Long. 37, diam. 18 mm.

*Type locality.* Tihoe, island of Wetar.

Specimen examined 1.

(14) *Clausilia (Pseudonenia) simillima kabaënæ*, subsp. n.

Nearly allied to typical *Cl. simillima*, but easily distinguished from it by its smaller size and by its mouth being

much more elliptical and not so high as in specimens of the typical form.

Long. 18.5, diam. 3.5 mm.

*Type locality.* Kabaëna Island, off S.E. Celebes.

Specimens examined 6.

(15) *Prosopeas elberti*, sp. n.

Shell very high, imperforate, subsolid, finely striated, pale corneous; spire high conic, turreted, apex very blunt; whorls  $10\frac{1}{2}$ , the upper ones somewhat convex, the others nearly flat, gradually increasing in breadth; suture incised; aperture piriform, rather acute above, effuse basally; peristome sharp, not reflexed, terminations connected by a flat shining callus, columellar margin whitish, somewhat thickened.

Long. 36.5, diam. 10 mm.

*Type locality.* Sadjang, Lombok.

Specimen examined 1.

(16) *Prosopeas hasta*, sp. n.

Shell imperforate, cylindric-turreted, densely and minutely striated, whitish corneous; spire very high and slender, apex obtuse, suture rather deep, impressed; whorls  $10\frac{1}{2}$ , the upper ones somewhat convex, the others more flattened; aperture nearly vertically, narrowly piriform, acute above; peristome thin, columellar margin thickened, reflexed.

Long. 16, diam. 4.5 mm.

*Type locality.* Swela, Lombok; some more specimens from Sadjang, Lombok.

Specimens examined 3.

(17) *Limnæa javanica elbertæ*, subsp. n.

Distinguished from typical *L. javanica* by its higher spire, less convex whorls, and enormous fragility.

Long. 27, diam. 14.5 mm.

*Type locality.* Swamps of Sembaloen Plain, Lombok.

Specimens examined 135.

(18) *Limnæa javanica nana*, subsp. n.

A dwarfed solid form of *L. javanica*, with flattened whorls and thickened, reflexed peristome.

Long. 11, diam. 6 mm.

*Type locality.* Rapids of Kali Poetih River, Lombok.

Specimens examined 26.



(19) *Planorbis (Gyraulis) elberti*, sp. n.

Shell discoidal, rather thin, semitransparent, pale horn-colour; spire somewhat concave; whorls  $5\frac{1}{2}$ , rapidly increasing, densely striated, the last obtusely carinated at its periphery; suture deeply impressed; base of shell concave; aperture somewhat rhomboidal, a little broader than high, rounded above and below, angulated laterally; peristome thin, acute.

Diam. maj. 7.5, diam. min. 6.5 mm.; alt. 1.75 mm.

*Type locality.* Swamps of Sembaloen Plain, Lombok; some more specimens from Sadjang, Lombok.

Specimens examined 47.

(20) *Cyclotus discoideus*, sp. n.

Shell very depressed-conic, nearly discoid, widely umbilicated, solid, faintly and densely striated above and below, pale horn-colour, marbled with dark brown, and with a narrow dark subperipheral band; apex obtuse; whorls  $4\frac{1}{2}$ , regularly increasing, the last slowly descending anteriorly; suture well impressed; aperture circular, somewhat oblique; peristome double, the inner margin simple, the outer thickened and somewhat expanded.

Diam. maj. 18.5, diam. min. 15 mm.; alt. 11 mm.

*Type locality.* Kabaena Island, off S.E. Celebes.

Specimens examined 17.

(21) *Cyclophorus wetaranus*, sp. n.

Shell somewhat depressed-conic, umbilicated, solid, very faintly striated above, nearly smooth below, pale to dark horn-colour, with very indistinct darker markings and a narrow dark subperipheral band; apex obtuse; whorls 5, regularly increasing, the last swollen, somewhat descending anteriorly; suture distinctly impressed; aperture circular, somewhat oblique; peristome somewhat thickened, slightly expanded, with a slight whitish callus inside.

Diam. maj. 14, diam. min. 11 mm.; alt. 11.5 mm.

*Type locality.* Ilwaki, Wetar; other locality, Tihoe, Wetar.

Specimens examined 9.

(22) *Lagochilus tricarinatus*, sp. n.

Shell conic, umbilicated, solid, with a strong peripheral and a faint keel both above and below it, finely striated, horn-

colour, with dark undulating oblique striæ between the suture and the uppermost keel; apex distinctly marked; whorls 6, rapidly increasing, the last somewhat descending anteriorly; suture well impressed; aperture oblique, circular; peristome somewhat thickened and expanded, the margins connected by a faint columellar callus.

Diam. maj. 7, diam. min. 6.25 mm.; alt. 6.5 mm.

*Type locality.* Kabaëna Island.

Specimen examined 1.

(23) *Leptopoma celebesianum concolor*, subsp. n.

Smaller than typical *L. celebesianum*, wider umbilicated, extremely fine sculptured, and of a uniform whitish colour.

Diam. maj. 8.5, diam. min. 7 mm.; alt. 8.25 mm.

*Type locality.* Mengkoka, S.E. Celebes.

Specimen examined 1.

(24) *Vivipara javanica soembawana*, subsp. n.

Differs from typical *V. javanica* by its more globular general form, lower spire, and more convex whorls.

Diam. maj. 18, diam. min. 16 mm.; alt. 23 mm.

*Type locality.* Dompoe, Soembawa.

Specimen examined 1.

(25) *Vivipara javanica lombocensis*, subsp. n.

This local form is strikingly similar to *V. javanica borneensis*, Kob., from which it is distinguished by its smaller size, lower spire, better impressed suture, and more convex whorls.

Diam. maj. 17.5, diam. min. 15 mm.; alt. 23 mm.

*Type locality.* Bajan, Lombok.

Specimens examined 16.

(26) *Neritina (Clithon) soembawana*, sp. n.

Shell semiglobose, very solid, densely striated or rugose, without spines, greyish brown to dark brown, dull, often very indistinctly marbled; last whorl distinctly shouldered; aperture white or yellowish white; columellar area rather smooth, columellar edge finely dentate and with a blunt tooth in its upper part.

Diam. 20.5, alt. 17 mm.

*Type locality.* Bima, Soembawa.

Specimens examined 19.

(27) *Neritina (Neritina) wetarana*, sp. n.

Shell semiglobose, very solid, densely and minutely striated, light brown with an irregular black network pattern, or a nearly uniform black with small yellow markings; apex distinctly marked; aperture bluish white; columellar area smooth, polished.

Diam. 20, alt. 19 mm.

*Type locality.* Ilwaki River, near Ilmedo, Wetar.

Specimens examined 19.

(28) *Septaria elberti*, sp. n.

Shell oviform, rather rounded anteriorly, somewhat pointed behind, moderately inflated, rather solid; apex very distinctly projecting beyond the posterior margin, worn away below; epidermis light to dark brown, with narrow, oblique, dark bands showing the tendency to form a network laterally and posteriorly; septum rather broad, with a distinctly convex margin; inside uniformly bluish white.

Length 24.5, breadth 20, height 8 mm.

*Type locality.* Kali Spi, Flores; some more specimens from an unnamed locality in Flores.

Specimens examined 7.

(29) *Tarebia celebensis boetonensis*, subsp. n.

Distinguished from typical *T. celebensis* by its much more conic spire, more convex last whorl, and by the sculpture showing nodules only on the upper part of the whorls.

Length 24, diam. 9.5 mm.

*Type locality.* Lipoemangaoe, S.E. Boeton.

Specimens examined 13.

(30) *Plotia scabra sublaevis*, subsp. n.

A slender, high conic, and nearly smooth form of *P. scabra*, related to von Martens's *P. scabra mutica*, but distinguished from it by its higher whorls, by a very indistinct angle on the uppermost portion of the last two whorls, and by its high, narrow, piriform aperture.

Length 26, diam. 11 mm.

*Type locality.* Sadjang, Lombok.

Specimens examined 12.

(31) *Melanoides striatissimus*, sp. n.

Shell high conic, solid, light brown to black, often with

very distinct marks of growth; whorls  $9\frac{1}{2}$ , the upper ones smooth, somewhat flattened, the last three with numerous elevated spiral ledges, rather convex, especially the last; suture moderately impressed; aperture piriform, greyish white inside; columella somewhat bent in.

Length 32.5, diam. 12 mm.

*Type locality.* Kabaëna.

Specimens examined 23.

(32) *Melanoides crepidinatus ventricosulus*, subsp. n.

Distinguished from typical *M. crepidinatus* by its more slender general form and by its much more convex last whorls; adult specimens are always decollated.

*Type locality.* Mengkoka, S.E. Celebes.

Specimens examined 28.

(33) *Melanoides tuberculatus nudatus*, subsp. n.

A high smooth form of *M. tuberculatus*, nearly related to *M. tuberculatus seminudus*, Marts., but easily distinguished from it by its more convex whorls, deeply impressed suture, pointed apex, and by the nearly complete lack of spiral sculpture.

Length 34, diam. 12 mm.

*Type locality.* Segare Anak, Lombok.

Specimens examined 45.

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LIV.—*Descriptions of new Reptiles from the Andes of South America, preserved in the British Museum.* By G. A. BOULENGER, F.R.S.

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*Tropidurus holotropis.*

Upper head-scales large, keeled; a series of four transversely enlarged supraoculars, more than half as broad as the supraocular region; occipital very large, as long as broad; anterior border of ear scarcely denticulated. A strong transverse gular fold; side of neck with imbricate keeled scales, directed backwards and upwards. Body moderately depressed; a vertebral crest, well developed on the nape, gradually decreasing in height on the body; dorsal scales



rather large, strongly keeled and mucronate, the keels directed obliquely towards the vertebral line; ventral scales smaller, also strongly keeled; 49 scales round the middle of the body. The adpressed hind limb reaches the eye. Tail cylindrical, without crest, covered with unequal-sized scales, the largest of which are smaller than the dorsals. Dark brown above and on the throat; small black spots on the back and on the hind limbs; a large, black, light-edged spot at the angle of the mouth; gular fold white in front, black behind; fore limb pale grey, with black bars; belly brownish.

	mm.
Total length .....	260
Head .....	19
Width of head .....	18
Body .....	56
Fore limb .....	43
Hind limb .....	60
Tail .....	185

A single specimen from Alpayaca, Rio Pastaza, E. Ecuador, 3600 feet, from the collection of Mr. M. G. Palmer.

*Ptychoglossus brevifrontalis.*

Head short; snout subtruncate. Frontonasal broader than long; præfrontals forming a short suture; frontal not longer than broad, but slightly longer than the frontonasal or the frontoparietals; interparietal nearly as broad as the parietals; no occipitals; a small loreal; seven upper labials, third very long; five lower labials; chin-shields very large, one anterior and three pairs, the first two pairs in contact on the median line. Gular scales squarish, in 7 transverse series; collar formed of 7 shields. Dorsal scales in 24 longitudinal and 33 transverse series; ventrals a little longer than broad, in 8 longitudinal and 18 transverse series. Four præanals, median pair the larger. The hind limb reaches the wrist, the fore limb between the ear and the eye; scales on limbs smooth. 14 femoral pores on each side. Brown above, mottled with black; an interrupted yellowish streak on each side, from above the eye to the tail; below it a black streak, broken up into spots towards the middle of the body; lower parts white.

	mm.
Head .....	12
Width of head .....	10
From end of snout to fore limb .....	22
Fore limb .....	65
Fore limb .....	15
Hind limb .....	24

A single specimen from El Topo, Rio Pastaza, E. Ecuador, 4200 feet, from the collection of Mr. M. G. Palmer.

*Leptognathus palmeri.*

Body slender, strongly compressed. Eye large. Rostral broader than deep, just visible from above; internasals nearly half as long as the præfrontals; frontal slightly broader than long, shorter than its distance from the end of the snout and than the parietals; nasal divided; loreal a little deeper than long, bordering the eye, with a præocular above it; two postoculars; temporals 2+3; nine upper labials, fourth, fifth, and sixth entering the eye; first lower labial in contact with its fellow behind the symphysial; three pairs of chin-shields, anterior longer than broad. Scales in 15 rows, vertebrae enlarged but longer than broad. Ventrals 187; anal entire; subcaudals 120. Reddish brown, with broad blackish-brown annuli, edged with yellowish, on the anterior part of the body; further down these annuli are gradually replaced by pairs of large alternating spots which approximate on the vertebral line but are widely separated on the belly; head blackish brown, with yellowish-white bars on the labial shields and a few light dots on the loreal and temporal regions.

Total length 950; tail 310 mm.

A single male specimen from El Topo, Rio Pastaza, E. Ecuador, 4200 feet, from the collection of Mr. M. G. Palmer.

Allied to *L. alternans*, Fisch. Distinguished by the shorter frontal, the divided nasal, and the absence of a lower præocular. Distinguished from *L. boliviana*, Werner, from Bolivia, by the shorter frontal and the presence of two superposed anterior temporals.

*Leptognathus polylepis.*

Body slender, rather strongly compressed. Eye large. Rostral broader than deep, scarcely visible from above; internasals nearly half as long as the præfrontals; frontal as long as broad, a little longer than its distance from the end of the snout, much shorter than the parietals; nasal divided; loreal as long as deep, bordering the eye, with a præocular above it; two postoculars; temporals 2+3; nine upper labials, fourth, fifth, and sixth entering the eye; first lower labial in contact with its fellow behind the symphysial; three pairs of chin-shields, anterior a little longer than broad.

Scales in 19 rows, vertebrals not enlarged. Ventrals 199; anal entire; subcaudals 94. Black, with narrow, whitish, black-spotted cross-bars above, widening or bifurcating on the sides; a few whitish spots on the upper lip, behind the eye; belly lineolate with white.

Total length 950; tail 240 mm.

A single female specimen from Huancabamba, E. Peru, above 3000 feet, from the collection of Mr. E. Boettger.

Allied to *L. alternans*, Fisch. Distinguished from all the species of the genus by the number of rows of scales.

*Lachesis pleuroxanthus*.

Head short, cordiform; snout turned up at the end, with sharp canthus. Rostral a little deeper than broad; nasal divided; upper head-scales small, feebly imbricate, smooth on snout and vertex, feebly keeled on occiput, larger and more decidedly keeled on temples; supraocular large, separated from its fellow by 8 series of scales; internasals separated by a pair of apicals; two or three series of scales between the eye and the third and fourth upper labials; loreal pit separated from the upper labials; latter 7. Scales rather feebly keeled, in 23 rows. Ventrals 144; anal entire; subcaudals 49 pairs. Tail not prehensile. Greyish above, bright yellow on the sides, which bear  $\Lambda$ -shaped dark grey markings, some of which meet on the back, each branch terminating in a black spot; a dark streak, light-edged above, from the eye to the angle of the mouth; sides and lower surface of head bright yellow, without spots; belly closely mottled with blackish, with a series of large black spots on each side.

Total length 350; tail 55 mm.

A single female specimen from Alpayaca, Rio Pastaza, E. Ecuador, 3600 feet, from the collection of Mr. M. G. Palmer.

Closely allied to *L. microphthalmus*, Cope. Distinguished by the larger eye, the shorter body, and the feebly keeled scales.

*Lachesis chlorome'as*.

Snout rounded, with sharp canthus. Rostral as deep as broad; nasal divided; upper head-scales keeled; a large supraocular; 5 or 6 longitudinal series of scales between the supraoculars; small frontal and parietal shields sometimes present; two series of scales between the eye and the third and fourth upper labials; temporal scales strongly keeled;

7 upper labials, second forming the anterior border of the loreal pit. Scales strongly keeled, in 23 or 25 rows. Ventrals 178-187; anal entire; subcaudals 41 (♀) -63 (♂), partly single, partly in pairs. Tail prehensile. Yellowish green above, speckled with black, with large black irregular spots, some of which may form cross-bars; the spots very large on the top of the head, separated by narrow lines of the ground-colour forming symmetrical markings; a broad black band on each side from the eye to the angle of the mouth; lower parts greenish yellow, speckled or spotted with black; end of tail bright yellow.

Total length 740; tail 110 mm.

Three specimens from Huancabamba, E. Peru, above 3000 feet, from the collection of Mr. E. Boettger.

Closely allied to *L. peruvianus*, Blgr.; distinguished by the rounded snout without raised canthus, the presence of two series of scales between the eye and the labials, and the very different coloration.

LV.—*A Contribution to the Knowledge of the Fauna of Bromeliaceæ.* By HUGH SCOTT, M.A. (Cantab.), F.L.S., F.E.S., Curator in Entomology in the University of Cambridge. *Including Descriptions of new Insects by W. L. DISTANT, F.E.S., and the late R. SHELFORD, M.A., F.L.S.*

[Plate X.]

THE fauna inhabiting the spaces between the bases of leaves of Monocotyledonous plants in the tropics offers for investigation a fascinating field, in which that of the Bromeliaceæ is pre-eminent in its interest. The curious funnel-like form and closely fitting leaf-bases of these plants, adapting them for the holding of water and organic detritus, their distribution throughout the richest parts of the Neotropical Region, their vast numbers of individuals and frequent epiphytic habit, all lead to the expectation that they may contain a rich and interesting series of animal forms.

In a recent article\* on “les Broméliacées épiphytes

\* C. R. Ac. Sci., tome cliii. no. 20, 1911, p. 960: this article also contains interesting remarks on the means by which Bromeliaceæ may have become peopled by their fauna, &c.



comme milieu biologique," Monsieur C. Picado has likened the Bromeliaceæ and their contents taken as a whole to "un grand marécage fractionné, étendu dans toute l'Amérique intertropicale." The bromeliad marshes, he writes, are very different from terrestrial marshes, owing to their arboreal situation, restricted area, conditions of lighting, &c.; they are supplied not only with rain-water, but also with water condensed daily from the atmosphere, and so they may continue to contain water even at seasons when terrestrial marshes are dried up; substances do not undergo a real putrefaction in Bromeliaceæ\*, but the water in them is exceptionally pure. Dr. Ohaus also mentions (Stettin. ent. Zeit. 1900, p. 211) that the water in bromeliads does not disappear even in the dry season, and even in places where sometimes rain does not fall for months. From this it can be seen that the fauna is likely to be largely amphibious or aquatic in nature.

Professor P. P. Calvert, who has given much time to the study of the bromeliad fauna in Costa Rica, has published several articles on the subject, dealing particularly with the bromeliadiculous Odonate larvæ. Previously to his researches nothing was known of the early stages of the remarkable dragonflies of the genus *Mecistogaster*, the larvæ of which are among the most interesting of the bromeliad dwellers. In one paper he states that various forms of animal life are found in the Bromeliaceæ in many localities, *i. e.* at very different elevations and consequently under very different climatic conditions: "cockroaches, earwigs, katydid-like insects, larvæ of beetles, of moths, of flies and of mosquitos, ants . . . ., snails, earthworms, scorpions, both true and false, centipedes, and even snakes of poisonous repute are common *bromeliadicoli* which we met in our examinations"†. In another article is given a long list‡ of the creatures found in a single clump of Bromeliaceæ near Juan Viñas, a list which includes Odonate larvæ, a scorpion and a pseudoscorpion, Phalangids, Coleoptera and Colcopterous larvæ of many kinds (including Hydrophilidæ, Elateridæ, a Lampyrid, an Endomychid, a weevil, &c.), Lepidopterous and Dipterous larvæ, two Heteropterous bugs, an earwig, an

\* See a second article by Picado, C. R. Ac. Sci., tome cliv. no. 9, 1912, p. 607.

† From 'Old Penn.' Weekly Review of the University of Pennsylvania, ix. no. 6, pp. 165-170 (1910): an extract is given by Champion in Ent. Mo. Mag. xxii. 1911, p. 17.

‡ Ent. News Philad. xxii. 1911, pp. 402-11: the list referred to above is quoted *in extenso* in Ent. Rec. xxiv. 1912, p. 76.

ant, &c. In another place in the same paper (p. 407) spiders, slugs, and planarians are mentioned as being found in Bromeliaceæ; and (on p. 411) Morton is cited as writing (*in litt*) that Fritz Müller once sent him cases of caddis-fly larvæ found in epiphytic bromeliads in the primæval forests of Southern Brazil.

To quote again the work\* of Dr. Ohaus: in Brazil he found that large Bromeliaceæ, growing both on trees and on steep rock-faces, were rich hunting-grounds, containing beetles (particularly Tenebrionidæ), many kinds of spiders, myriapods, *Peripatus*, and numbers of Blattidæ. In the water in the bromeliads he frequently found tree-frogs, which deposit their spawn there; and he considers this not an exceptional but a normal habit, persisted in even when terrestrial pieces of water are quite close at hand. In a later record† of South American travel he records finding a dung-beetle, *Aphengium seminudum*, Bates, usually several specimens together, in large Bromeliaceæ. These lists are summarized to show the extent of the bromeliad fauna, and for the sake of comparison with the results of my bromeliad collecting in the West Indies, given below.

My own interest in the matter was roused by my experiences in the Seychelles Islands during the Percy Sladen Trust Expedition of 1908-9. Some of the most interesting species of beetles were found there between leaf-bases of certain endemic species of palms and *Pandanus*, notably a true water-beetle (Dytiscid) in the latter. In the paper describing my experiences a short account‡ is given of this form of collecting, with a list of the creatures found in leaf-bases of palms and *Pandanus*: a list which includes earthworms, planarians, snails, woodlice, a scorpion, Lepidopterous and Dipterous larvæ, Coleoptera and Coleopterous larvæ of very different forms, earwigs, and a very peculiar flattened form of cockroach described by Bolivar as a new genus (*Hololeptoblatta*: a find in *Pandanus* very interesting in connection with the discovery of the interesting new bromeliadiculous cockroach described below).

Thus in the tropics of both hemispheres, and in other plants besides Bromeliaceæ, an interesting and largely aquatic or amphibious fauna dwells between the bases of the leaves. Nor does this exhaust the list of curious situations in which aquatic insects have been found in plants. In

\* Stettin. ent. Zeit. 1900, pp. 211, 212.

† *Op. cit.* 1909, p. 26.

‡ Trans. Linn. Soc. London, ser. 2, Zool. vol. xiv. 1910, p. 24.

Trinidad I was informed that many Culicid larvæ are sometimes found in the water that collects in the strange inflorescences of *Heliconiæ* (wild Musacæ) ; and in the Sandwich Islands Dr. Perkins found that nymphs of some dragonflies exist and complete their development in the water accumulated in the leaves of lilies growing on dry land\*.

Therefore, during a short visit to Trinidad and Dominica in March of this year, I determined to try to see something of the bromeliad fauna. I was only able to examine Bromeliaceæ for this purpose on three occasions, in a single locality in Trinidad and in two localities in Dominica. A brief account of these investigations will be given, followed by descriptions of four new species of bromeliadicolous insects.

I. TRINIDAD.—The locality was the actual summit of the highest mountain in the island, El Tucuché, 3100 feet, in the northern range of hills. My visit was made on March 20th, in company with Mr. F. W. Ulrich, Government Entomologist, and Mr. W. G. Freeman, Assistant Director of Agriculture, to both of whom I am greatly indebted for much kindness and help. Having left Port of Spain at daybreak and travelled by rail to St. Joseph, formerly the capital, we then drove northwards into the mountains up the Maracas valley as far as the road is passable for vehicles. We then climbed the steep side of the valley-head through cacao-plantations till we arrived at a gap or saddle between two peaks high in the hills. Pushing our way through a dense bed of *Heliconiæ*, the broad banana-like leaves of which reached some way over our heads, we crossed the gap and emerged on to the track leading to the mountain-top. From this point we followed the track to the summit, mounting gradually for about 4 miles through a dense tropical forest of extreme beauty. In the higher part especially was an indescribable luxuriance of vegetation, very noticeable being many graceful palms of several kinds (*Euterpe*, *Bactris*, *Geonoma*, &c.), an extraordinary wealth of ferns, Lycopodiaceæ, climbing and epiphytic Aroids, lianes, and epiphytic Bromeliaceæ often with gaudily-coloured inflorescences, not to mention the many kinds of Dicotyledonous trees. Immediately below the summit the forest becomes somewhat stunted, and trunks and branches of trees wear a shaggy clothing of thick moss. At the actual summit a small area is cleared and a little wooden camping-house has been built. On the way through the forest we had been

\* See Sharp, 'Cambridge Natural History,' vol. v. pp. 425-6.  
29\*

delayed by heavy rain, and at the summit found ourselves in a chilly driving cloud, the difference of temperature between this place and the lowlands being so great that one gladly sought the shelter of the house. Later the cloud rolled off, disclosing a magnificent view, southward over the low-lying level central part of the island, and northward over those peaks and forests and that beautiful northern coast which form the subject of one of the most charming chapters in Kingsley's 'At Last.'

In contrast with the climatic conditions on the mountain, the country in the lowlands was extremely parched, the dry season being at its height, and a severe drought, such as had not been experienced for years, prevailing in addition. But in the mountain-forests moisture is perennial, and the water between the bromeliad leaves would never dry up—an important fact with reference to the amphibious and aquatic nature of the bromeliad fauna.

During the hour spent on the summit we collected a sample of this fauna. One or two plants of a species of *Tillandsia* were taken by Mr. Ulrich from two or three feet above the ground (it being very difficult to get at specimens perched in lofty trees) and brought into the house, where the leaves were stripped off one by one, from outside inwards. In the water and humus between their bases were found the following:—

Two specimens of a small frog; a millipede; crustaceans (Isopoda); Odonate larvæ, about which I shall say nothing, as they are being further investigated by Mr. Ulrich; an earwig, determined by Dr. Burr as an immature *Psalid*, perhaps *Psalis americana*; numbers of a new species of cockroach, *Homalopteryx scotti* (described below by Shelford), adults of both sexes and young in several stages; large numbers of a Coleopterous larva, either of or allied to the genus *Helodes* (mentioned again below); a series of a new Dytiscid beetle, *Aglymbus bromeliarum* (described below); several of a new Hydrophilid, *Cyclonotum urichi* (described below); four specimens of a species of *Trichopteryx* (determination of the genus due to Mr. H. Britten); a single specimen of a Thysanopteron, determined by Mr. R. S. Bagnall as a species of *Eupathithrips* Bagn.\*; and, lastly, a number of a new Hemipteron, *Microvelia insignis* Distant (described below).

Of these the Dytiscid (*Aglymbus*), the *Microvelia*, the Odonate larvæ, and the Helodine larvæ are purely aquatic

\* = *Heterothrips* Bufla (nec Hood), = *Polygonmatothrips* Bufla (teste Bagnall).



insects. The finding of the *Aglymbus* is specially interesting in connection with the previous discovery, already referred to above, of a tree-inhabiting species of the allied genus *Copelatus* in the Old-World tropics—i. e. *Copelatus pandanorum*, which lives in the water between leaf-bases of *Pandanus* in the perennially moist mountain-forests of the Seychelles. Beyond these two species I am unaware that any Dytiscid has been found inhabiting trees. The larvæ of Helodiinæ are aquatic, e. g. those of *Helodes minuta* live beneath stones submerged in streams; and *Microvelia* belongs to a group the members of which run on the surface of fresh water. As to the Hydrophilid, the members of the genus *Cyclonotum* might be described as subaquatic, most of them appearing to live in decaying vegetable refuse which often contains much moisture. Shelford has called attention (below) to an adaptation of the new cockroach (*Homalopteryx*) for an amphibious existence. In this connection nothing can be said at present with regard to the *Trichopteryx* or the *Eupathithrips*; but the facts just summarized, in conjunction with the presence of the frogs, show the aquatic or amphibious nature of the bromeliadiculous fauna.

It may be asked if the truly aquatic insects show any special adaptation for living in the Bromeliaceæ as compared with their congeners which inhabit waters on the ground. The *Aglymbus* is more flattened dorso-ventrally than its congeners, this being perhaps an adaptation for living in the narrow spaces between the leaf-bases (*Copelatus pandanorum* is also flattened). I am unaware of any special adaptation in the *Microvelia*. The Helodine larvæ are less flattened than those of *Helodes minuta*, which live under stones; and Prof. Carpenter considers the bromeliadiculous larvæ the less specialized of the two (see below).

In a letter to me Mr. Urich writes:—"If these beetles [the *Aglymbus*] are confined to higher elevations and must live at the tops of our highest hills, then they are entirely confined to *Bromelia*-water, as the tops of several hills of the Northern Range appear to have no other water" within a mile of the summit by road, or, vertically, above 2500 feet\*. Mr. Urich refers to the fact that, although there is extremely abundant moisture on the mountain-tops, yet there are no pools or streams, and the only water in which truly aquatic insects such as Dytiscidæ could live is that which collects between leaf-bases, in inflorescences, &c. The same statement applies to the highest parts of the Seychelles forests;

\* Mr. Urich adds that he has seen frogs similar to those found by us in the same kind of bromeliad at similar elevations on other peaks.

they are saturated with moisture, but there are no pools, and though swift mountain-streams are numerous at lower levels, they are not present on the peaks; so that on those peaks the only water in which aquatic insects can exist is that which accumulates in hollow leaves, pitchers of *Nepenthes*, leaf-bases of *Pandanus*, &c. In speaking of the lily-dwelling Odonate larvæ referred to above Dr. Sharp states that the Sandwich Islands are extremely poor in stagnant waters; in large areas of forest the only water that Odonata can find for their larvæ to live in may be small accumulations in plants.

II. DOMINICA.—In this island I made two excursions, on both of which I was accompanied and guided by Mr. Jones, Assistant at the Botanic Station at Roseau, who aided me in collecting, and to whom I am greatly indebted for his kindness. On March 29th we rode to a point above the freshwater lake, whence a view is obtained in two directions—westward down the valleys towards Roseau and the leeward coast, and eastward down on to the windward coast. I am uncertain of the elevation, but it is in the neighbourhood of 3000 feet, probably over. Two or three plants of an undetermined bromeliad, growing just low enough to be reached, were taken from trees growing at the roadside edge of the luxuriant forest. These contained numbers of Helodine larvæ very similar to, or perhaps identical with, those found in Trinidad; three specimens of a small Staphylinid beetle, which Mr. Champion tells me is a new species of *Stammoderus* near to *S. optatus* Sharp; one worn specimen of a Barid weevil, possibly a species of *Nicentrus* Casey (*teste* Champion); one (wingless) specimen of a *Microvelia*, determined by Mr. Distant as identical with the new species (*M. insignis*) found in Trinidad Bromeliaceæ; and some Chironomid larvæ.

On March 30th we visited a piece of virgin forest at an elevation somewhat over 1000 feet in the mountains behind Roseau. Here, in a single epiphytic bromeliad, numbers of the Helodine larvæ were again met with: in my journal I wrote that Hydrophilidæ and a *Trichopteryx* were also seen, but these are not now forthcoming and were perhaps lost in the hurry of departure; and a single specimen was captured of a cockroach, determined by Mr. Shelford as a well-known species, *Epilampra conspersa* Burm. Some, at any rate, of the species of *Epilampra* are amphibious, and in the specimen before me the spiracular tubes can be seen projecting from

beneath the antepenultimate abdominal tergite as clearly as they can in the new *Homalopteryx* \*.

NOTE ON THE HELODINE LARVÆ.—Professor G. H. Carpenter has kindly determined these larvæ, of which such numbers occurred in the Bromeliaceæ, as being either members of or closely related to the genus *Helodes*. No imago to which they could belong was found. They are long and narrow, not tapering much towards the posterior extremity, flattened dorso-ventrally, with filamentous antennæ nearly as long as their bodies, and a group of rectal gills. Prof. Carpenter writes (*in litt.*) that they are closely like the larvæ of *Helodes minuta*, but on the whole less specialized, being less flattened dorso-ventrally. He and Miss MacDowell have recently published (Quart. J. Micr. Sci., vol. lvii. part 4, 1912, p. 373) a very interesting paper in which the mouth-parts of the larva of *Helodes minuta* are described and figured. I have made preparations of the mouth-parts of two of the bromeliadiculous larvæ, and on a cursory examination find them much like those of *H. minuta* in general structure, though differing in detail (especially in the form of the labrum, which is strongly emarginate); the hypopharynx and maxillulæ appear much as they do in pl. xxxv. fig. 11 of the paper just cited.

#### DESCRIPTIONS OF NEW SPECIES.

##### Blattidæ.

##### 1. *Homalopteryx scotti*, sp. n. (Pl. X. figs. 1 & 2.)

♂. Head and antennæ rufo-castaneous; vertex of head freely exposed, smooth, impunctate; eyes widely remote, their distance apart and that of the antennal sockets equal; ocelli distinct, closer together than the eyes. Pronotum trapezoidal, anteriorly and posteriorly subtruncate, impunctate, nitid, castaneous, broadly bordered laterally with ochreous, a narrow line of the same colour on the anterior border, extreme outer lateral margins castaneous. Scutellum not visible. Tegmina ovate, semicorneous, not extending beyond the middle of the antepenultimate segment of the abdomen, impunctate, strongly overlapping, marginal area

\* See Shelford, below, under the description of *Homalopteryx scotti*; also his papers in 'Zoologist,' vol. xi. 1907, p. 221, and 'Records of the Indian Museum,' vol. iii. part 2, 1909, p. 125.

broad, costals regular, discoidal sectors oblique; castaneous, laterally bordered with ochreous, the band diminishing from before backwards; extreme outer margin of mediastinal area castaneous, mediastinal vein piceous; radial vein ridged on the under surface of the tegmina. Wings flavo-testaceous, equal in length to tegmina; costals irregular; 11 ulnar rami, 4 being incomplete. The abdomen above yellow-brown, the disc dark, posterior angles of distal tergites dentately produced; beneath castaneous. Supra-anal lamina subbilobate, barely exceeding the subgenital lamina, which is narrow, produced, slightly asymmetrical (Pl. X. fig. 2), and with two small slender styles. Cerci short, pointed, piceous, the two apical joints ochreous. Legs rufo-castaneous; femora strongly armed, front femora with three to four spines on the anterior margin beneath; formula of apical spines  $\frac{2}{1}, 1, 1$ ; no genicular spines on front femora. Tibiæ triseriately spined on their outer aspect. Tarsi short, with large pulvilli and arolia; metatarsi quite unarmed beneath; posterior metatarsus rather shorter than the succeeding joints.

♀. Resembles the ♂, but is larger, the ochreous margins of the pronotum and tegmina translucent; the tegmina and wings are shorter and the abdomen is dark castaneous in colour both above and beneath; supra-anal lamina slightly more produced, and subgenital lamina ample, produced, with sinuate margins.

*Larvæ* dark castaneous, variegated with rufous in some specimens; lateral margins of the thoracic tergites translucent ochreous.

*Measurements* (♂ and ♀ types).—Total length (♂) 28, (♀) 38.5 mm.; length of tegmina (♂) 16, (♀) 19 mm.; greatest breadth of abdomen (♂) 14, (♀) 19 mm.; pronotum (♂)  $8 \times 12$ , (♀)  $9.5 \times 14.2$  mm.

*Loc.* Trinidad, summit of El Tucuché, 3100 feet, 20. iii. 1912; from leaf-bases of *Tillandsia* sp., 2 ♂, 4 ♀, 7 larvæ.

*Type* (♂) and one paratype (♀) presented to British Museum, and one paratype (♀) to the Hope Museum, Oxford; remaining paratypes and larvæ in Cambridge University Museum.

A certain amount of water collects in the spaces between the leaf-bases, and the cockroaches must therefore lead a more or less aquatic life; the spiracular tubes which in both sexes are clearly visible, projecting from beneath the antepenultimate abdominal tergite, show that this species is as well adapted for an aquatic existence as those Oriental



forms of *Epilampra* and *Rhcnoda* described by me\*. It is quite possible that a new genus will have to be erected eventually for this species, since in the free exposure of the vertex of the head it differs from typical *Homalopteryx*; but at present it may be allowed to rest in that genus. Hitherto *Homalopteryx* was represented in the New World by but a single species, *H. capucina* Brunn., from Venezuela, the type of the genus.—R. SHELFORD †.

## COLEOPTERA.

2. *Aglymbus bromeliarum*, sp. n. (Pl. X. fig. 3.)

♂. Depressus, ovatus, subopacus, persubtilissime reticulatus, corpore supra subtusque omnino nigro, palpis antennisque pedibusque piceo-rufis; capite subtilissime punctato et breviter longitudinaliter striolato, antice utrinque impresso; prothorace tote tenuiter longitudinaliter striolato, ante angulos posteriores leviter curvatim impresso; elytris omnino dense longitudinaliter striolatis, striis 6 tenuibus, parte anteriore striæ suturalis tenuissima, interdum obsoleta, stria submarginali nulla; tibiis anticis ad basin attenuatis, curvatis, intus leviter emarginatis; tarsorum anticorum mediorumque articulis 1-3 dilatatis.

♀. Striolis longitudinalibus in capite et in parte media prothoracis fere obsoletis; tibiis anticis simplicibus, tarsis haud dilatatis.

Long. corp. (♂ ♀) 5-6 mm.

Depressed, ovate, body entirely black above and beneath, with mouth-parts reddish, and palps, antennæ, and legs pitchy red; subopaque, the entire surface extremely finely reticulate ‡. *Head* extremely finely punctured, with short fine longitudinal striolæ in addition to the punctures, these striolæ, however, much fewer or nearly absent in ♀; on either side in front is a marked impression bearing several larger punctures, and there are also one or two larger punctures behind and nearer to the eye than this impression; in some specimens a vague median impression on the back of the head is present. *Prothorax* entirely covered with short fine longitudinal striolæ in the ♂; in ♀ these striolæ are more strongly marked at the sides and are present along the

\* See footnote on p. 431.

† These specimens were examined and the description made by Mr. Shelford about three weeks before his death. He gave his assent in a letter to my publishing the description in this paper.—H. SCOTT.

‡ This fine reticulation of the entire surface of the chitin is not to be confounded with the sculpture of striolæ described below.

anterior and posterior margins, but become obsolete in the median part of the disc. A median longitudinal impression, abbreviated before and behind, is sometimes present on the disc, and the base has a slight impression on either side about halfway between the middle and the posterior angle. A series of punctures extends across the thorax immediately behind the front margin; it continues as an impressed series along each side, in the front part running parallel to the lateral margin, but behind curving inwards away from the side and approaching the basal impression. *Scutellum* smooth. *Elytra* entirely and closely covered with very numerous fine striolæ, elongate and rather irregular in direction, appearing to form a network of elongate meshes, though few, if any, of the striolæ are actually connected with one another; each elytron has six very fine striæ on the disc, reaching almost to the base, though striæ 1 and 3 are extremely fine in front, stria 1 (the sutural stria) being sometimes obsolete in its anterior portion; striæ 2, 4, 6 are a little more strongly marked and finely punctured; striæ 5 and 6 are closer together than the others are to one another; the striæ do not quite reach the apex, 2 and 4 are a little shorter than 1, 3, and 5, and 6 is the shortest of all; the apical portion of the elytron beyond the ends of the striæ bears some punctures; there is no submarginal stria, but a series of punctures, rather difficult to see, close to the margin. *Metasternum* without striolæ or punctures. *Hind coxæ* and abdominal segments 1 and 2 with numerous fine striolæ, segments 3-6 smooth.

*Loc.* Trinidad, summit of El Tucuché, 3100 feet, 20. iii. 1912; from between leaf-bases of *Tillandsia* sp., 4 ♂, 5 ♀.

*Type* (♂) and one paratype (♀) presented to British Museum; remaining paratypes in Cambridge University Museum.

A sculpture of longitudinal striolæ on the upper surface is very characteristic of the genus *Aglymbus*. Most of the previously known species have only the striolæ and no striæ on the elytra, but *A. bromeliarum* has both striæ and striolæ. In this one character it resembles the two Abyssinian species (*A. gestroi* Sharp and *A. brevicornis* Sharp) more than it does the South American species; but they only have four striæ on each elytron, while it has six. In fact, *A. bromeliarum* is unlike any of the other species of the genus. Several of the South American species which I have seen in Dr. Sharp's collection are very different; in addition to being devoid of elytral striæ, they are narrower and much

less flattened, and the striae are much coarser and stronger. In *A. bromeliarum* both striae and striæ are very fine indeed, forming a remarkable and beautiful sculpture; a rather similar type of elytral sculpture is to be seen in *Copelatus incognitus* Sharp (Biol. Centr.-Am., Col. i. 2, p. 38), though that insect is absolutely different in other respects.

*Aglymbus* closely resembles *Copelatus*, but is distinguished therefrom by the absence of coxal lines. Seven species were enumerated in Dr. Sharp's monograph 'On Dytiscidæ' (p. 596), five from South America and two from Abyssinia. He stated (*op. cit.* p. 893) that they are "excessively rare." Van den Branden, in his Catalogue of Dytiscidæ published in 1885, three years after Dr. Sharp's monograph, only gives the same seven species (Ann. Soc. ent. Belgique, xxix. p. 87), and, although I have searched, I have found no record of any species being added to the original seven up till now. It is just possible that an *Aglymbus* might be described as a *Copelatus*; but though I have looked up the descriptions of many species of *Copelatus* published since Dr. Sharp's monograph, I have found none in the least resembling *Aglymbus bromeliarum*. Possibly further investigation of the fauna of Bromeliaceæ will add to our knowledge of the rare genus *Aglymbus*.—H. SCOTT.

### 3. *Cyclonotum urichi*, sp. n.

Oblong-ovale, convexum, nitidum, corpore supra subtusque nigro, antennis palpisque flavescentibus, pedibus picco-ferrugineis; capite conspicue lato, subtiliter crebre punctulato, ad marginem anteriorem persubtilissime reticulato; prothorace subtiliter crebre punctulato; elytris dense parum fortius punctulatis, punctorum seriebus nullis, stria suturali postice tenuissima, dimidio anteriore omnino obsoleta; tarsis intermediis et posticis brevibus, hirsutis, articulo basali incrassato.

Long. corp. ca.  $4\frac{1}{4}$  mm.

Oblong-oval but not elongate, rather less convex than some members of the genus. *Head* very broad and short, scarcely narrowing in front of the eyes except for the rounding off of the angles, with the front margin straight; closely and finely punctured; towards the anterior margin very finely reticulate, this portion appearing dull, while the rest of the head and all the remainder of the upper surface are strongly shining. *Thorax* closely and finely punctured. *Scutellum* very finely punctured. *Elytra* very closely punctured (if anything a little more closely than the thorax), the

punctures fine but slightly stronger than those on the head and thorax. There are no traces of seriate punctuation. The sutural stria is visible as a very fine line in the posterior part of the elytron, but in the anterior half is quite absent. *Wing* examined in one specimen and found to be  $5\frac{1}{2}$  mm. long, the elytron being 3 mm. long. Middle and hind *tibiae* short, narrowed at base, with fine short spines on the anterior margin, a number of very short spines on the under surface near the apex, and two long strong spines on the inner side at the apex. Middle and hind *tarsi* considerably shorter than the tibiae, hirsute, with the basal joint incrassate and considerably longer than the second.

Being not quite satisfied as to the generic position of this insect, I add the following characters:—Eyes not emarginate in front; mentum broader than long, strongly impressed and concave in front (the concave part shining, the posterior part appearing very finely rugose-punctate); maxillary palpi short, second joint incrassate, terminal joint slightly longer than penultimate; labial palpi short, with basal joint short and transverse, second joint somewhat incrassate, with setae at its apex, terminal joint narrower and a little shorter than second; antennae 9-jointed, basal joint elongate and about equal to joints 2–6 together, joint 2 nearly as stout as basal joint, joint 3 slender; joints 4, 5, 6 very short and transverse; joints 7–9 forming a loose club; prosternum not longitudinally carinate in middle, not very short (longer in proportion than that of some members of the genus, *e. g.* *C. orbiculare*); mesosternum forming a somewhat elongate elevated lamina (much longer than in *C. orbiculare* and some other species), stretching back to meet the front of the metasternum, which is elevated medially but not produced far forward between the middle coxae: the produced part narrows in front and there is a depression where meso- and metasternum meet. Basal abdominal segment without a carina.

*Loc.* Trinidad, summit of El Tucuché, 3100 feet, 20. iii. 1912; from between leaf-bases of *Tillandsia* sp., 5 specimens.

*Type* presented to British Museum; paratypes in Cambridge University Museum.

This species is dedicated to Mr. F. W. Ulrich, Government Entomologist of Trinidad.

The very short broad head, oblong-oval form, and short, hairy, tapering tarsi give this insect a most distinct appearance. The tarsi somewhat resemble those of *Phenonotum*, but *C. urichi* is distinguished from that genus by the abso-



lutely different structure of meso- and metasterna and by the presence of a sutural stria on the posterior part of the elytra. Its prosternum is longer than in those species of *Cyclonotum* with which I have compared it; the raised mesosternal lamina is much more elongated and does not fit nearly so closely to the front of the metasternum, there being a depression at the point of meeting. The Central American *Cyclonotum posticatum* Sharp also differs from its congeners in having the mesosternal lamina much elongated, but in that species the lamina is differently formed and fits much more closely to the front of the metasternum than it does in *C. urichi*. The oblong-oval form of the body slightly recalls *Dactylosternum*, but *C. urichi* differs widely from that genus in the structure of its underside and in the entire absence of seriate punctuation on the elytra. Altogether it seems best to retain it as a very aberrant *Cyclonotum*.—H. SCOTT.

## HEMIPTERA.

4. *Microvelia insignis*, sp. n. (Pl. X. figs. 4 & 5.)

*Winged form*.—Head and pronotum black; hemelytra black, with rather more than basal third greyish white and a small spot at apex dusky grey; body beneath black; antennæ, rostrum, coxæ, and legs pale ochraceous, extreme apices of the femora infusate, apices of the tarsi black; antennæ with the first and second joints robust, first distinctly longer than second, third and fourth slender, a little the longest, and almost subequal in length; head with a central longitudinal subcarinate line; pronotum with the lateral angles obtusely prominent; hemelytra with the veins distinct and slightly ochraceous on the basal white area.

*Apterous form*.—Body above black, about basal half of connexivum very pale ochraceous, the first two abdominal segments obscure greyish.

Long. 2 mm.

*Localities*. Trinidad, summit of El Tucuché, 3100 feet, 20. iii. 1912; from between leaf-bases of *Tillandsia* sp., 1 winged and 6 wingless specimens. Dominica, from above freshwater lake, about 3000 feet, 29. iii. 1912; leaf-bases of undetermined bromeliad, 1 specimen (wingless).

*Type* (winged specimen) presented to British Museum; apterous specimens in Cambridge University Museum.

A very distinct species by the structure of the antennæ

and the prominent coloration of the hemelytra.—W. L. DISTANT.

#### EXPLANATION OF PLATE X.

- Fig. 1. Homalopteryx scotti*, sp. n. (Shelford), ♂.  $\times 1\frac{1}{2}$ .  
*Fig. 2. Ditto.* Apex of abdomen from beneath, showing subgenital lamina, cerci, and styles.  $\times 3$ .  
*Fig. 3. Aglymbus bromeliarum*, sp. n. (Scott), ♂.  $\times 10$ .  
*Fig. 4. Microvelia insignis*, sp. n. (Distant), winged form.  $\times 15$ .  
*Fig. 5. Ditto*, apterous form.  $\times 15$ .

#### LVI.—*Descriptions of some new Homoptera.*

By W. L. DISTANT.

##### Fam. Cicadidæ.

##### *Macrotristria occidentalis*, sp. n.

♀. Head and pronotum piccous, more or less ochraceously pilose, ocelli red; pronotum with the basal margin and an elongate spot on lateral margins behind eyes pale ochraceous; mesonotum castaneous, the disk more or less piccous, two central obconical piccous spots, margined with castaneous on anterior margin, extending over about half the disk, lateral margins longly greyishly pilose and also greyishly pilose between the anterior angles of the basal cruciform elevation; abdomen above black, greyishly pilose, the posterior segmental margins ochraceous; body beneath ochraceous, greyishly pilose and pubescent, a small castaneous spot on each side of the last ventral segment; face with the central sulcation and transverse ridges castaneous; tegmina and wings hyaline; tegmina with the venation black, the costal and greater part of the postcostal membranes and the claval vein ochraceous, basal cell and a basal longitudinal streak above it black, the whole venation of the apical areas broadly infuscated, posterior margin of the clavus mostly black; wings with the venation either ochraceous or black; front of head with the lateral areas obliquely carinate, the lateral areas of vertex also carinate; pronotum with a central, longitudinal, subcruciform carination; rostrum reaching the bases of the posterior coxæ; face moderately globose, the transverse carinations strong and distinct.

Long., excl. tegm., ♀, 30 mm.; exp. tegm. 92 mm.

*Hab.* West Australia, Southern Cross (*H. Brown*, Brit. Mus.).

I have only seen the female sex of this species, which may be placed near *M. hillieri*, Dist.

*Terpnosia crowfooti*, sp. n.

Head, pronotum, and mesonotum pale olivaceous green; head with anterior marginal lines to front, lateral margins to vertex, and the area of the ocelli black; pronotum with two central curved longitudinal lines, the outer fissure, a transverse spot near lateral angles, and two small, central, contiguous spots near base black; mesonotum with a central straight longitudinal line, on each side of which is a short inwardly curved line, a curved fasciate line on each lateral area, two spots in front of the basal cruciform elevation, and the anterior angles of the same black; abdomen pale brownish ochraceous, shortly palely pilose, the central area darker, with a series of large segmental spots on each lateral area and smaller spots on lateral margins piceous, apical segment covered with greyish-white pile; head beneath, sternum, legs, and opercula pale greenish ochraceous; tibiae, tarsi, and rostrum brownish ochraceous; abdomen beneath thickly covered with greyish pile; tegmina and wings hyaline, unspotted, both with the venation and the first with the costal membrane piceous; opercula in ♂ not extending beyond base of abdomen, their lateral and apical margins convex; tympanal coverings less than half the length of tympanal orifices, small and rudimentary.

Long., excl. tegm., ♂, 24 mm.; exp. tegm. 58 mm.

*Hab.* Badamtam, near Darjeeling (*A. R. Crowfoot*, Brit. Mus.).

By the completely unspotted tegmina and the rudimentary tympanal coverings this species is allied to *T. madhava*, Dist., from which it differs by the more elongate tegmina and totally different markings &c.

*Gudaba maculata*, sp. n.

Head, pronotum, and mesonotum ochraceous; head with the apex and two longitudinal fasciae to front, area of the ocelli, and an oblique fascia before each eye black; pronotum with two central longitudinal fasciae, a spot behind each eye, and the lateral fissure black; mesonotum with a central longitudinal line, on each side of which is a short oblique

linear fascia, a sublateral fascia (sometimes much broken), two small spots in front of the cruciform elevation, and the anterior angles of same black; abdomen brownish ochraceous, in ♂ a small black basal spot and the apical area castaneous, in ♀ a central black spot on the first three segments and a series of small lateral marginal spots; body beneath and legs brownish ochraceous in ♂, the apices of the femora distinctly black, and the apical area of the abdomen piceous or black; in the ♀ the underside of the body and legs is virescent; tegmina and wings hyaline, venation brownish ochraceous or fuscous; tegmina with a sublateral series of marginal fuscous spots placed on the lateral veins to apical areas; head as long as breadth between eyes; pronotum with the lateral angles angulated; abdomen considerably longer than space between head and base of cruciform elevation, second and third ventral segments furnished with a tubercle near each lateral margin, the posterior tubercle very small; tympanal coverings very much shorter and narrower than the tympanal orifices; opercula short, oblique, not passing the base of abdomen; rostrum reaching the posterior coxæ; wings with five apical areas.

Long., excl. tegm., ♂ ♀, 13 mm.; exp. tegm. 33-34 mm.

*Hab.* ♂, Sikkim (*Bingham*); ♀, Dehra Dun (*N. C. Chatterjee*, Brit. Mus.).

Allied to the Burmese species *G. marginata*, Dist., and constituting the first species described from India proper.

#### *Urabunana verna*, sp. n.

♀. Body virescent or greenish ochraceous; head with a black line on each side of front and a large irregular black spot on each side of vertex before the eyes; pronotum more ochraceous in hue, with the anterior and posterior margins and a central longitudinal fascia, widened posteriorly, pale virescent, near base this fascia contains a small quadrate black spot; mesonotum with four anterior black obconical spots, the two central smallest; abdomen above with a central black macular fascia reaching the penultimate segment, where it is narrowest; face centrally black; apex of rostrum black; tegmina and wings hyaline; tegmina with the veins infuscated, the costal and postcostal membranes pale virescent; lateral margins of the pronotum nearly straight, slightly amplified at posterior angles; tegmina a little arched towards apex of radial area and sinuate at the junction of costal and postcostal membranes;



wings with four apical areas; tegmina with eight apical areas.

Long., excl. tegm., ♀, 14 mm.; exp. tegm. 30 mm.

*Hab.* Australia; Byron Bay, N. S. Wales (*Ross*, Brit. Mus.).

### Fam. Jassidæ.

#### *Petaloccephala bombayensis*, sp. n.

Head, pronotum, scutellum, body beneath, and legs very pale virescent or greenish ochraceous; tegmina subhyaline, tale-like, the clavus and basal third of costal area pale virescent or greenish ochraceous, inner area of clavus more or less castaneous; lateral margins of vertex and pronotum, and a small central spot on anterior and posterior margins of pronotum, castaneous; vertex about as long as breadth between eyes, lateral margins almost straight for a little before eyes and then subangularly rounded to apex, centrally medially carinate; pronotum centrally, finely, longitudinally impressed, more or less distinctly transversely wrinkled; face strongly flattened from in front of eyes to anterior margin; posterior tibiæ outwardly strongly spinose.

Long., ♀, 9 mm.

*Hab.* Bombay (Brit. Mus.).

In general coloration allied to *P. nigrilinea*, Walk., but differing in the larger vertex of head, which is about as long as breadth between eyes.

#### *Petaloccephala perakensis*, sp. n.

Head, pronotum, scutellum, body beneath, and legs greenish ochraceous; lateral and anterior margins and a slightly curved transverse fascia near basal margin of vertex, and lateral margins (narrowly) and basal margin (broadly) to pronotum castaneous; tegmina castaneous; face with the anterior margin and two short angulate fasciæ on anterior area castaneous; lateral margins of sternum castaneous; vertex distinctly shorter than breadth between eyes, the lateral margins perpendicularly continued for a short space in front of eyes, and then obliquely continued to apex, centrally very finely longitudinally carinate; pronotum with the lateral margins nearly straight; clavus and costal membrane to tegmina very finely granulose, the venation on apical third very coarse and distinct; posterior tibiæ outwardly strongly spinose.

Long. 9 mm.

*Hab.* Malay Peninsula ; Perak (*Doherty*, Brit. Mus.).

Allied to *P. conspicua*, Dist., but differing by the shorter vertex, the lateral margins of which are perpendicular for a short distance in front of eyes, different markings to face, &c.

#### LEDROTYPA, gen. nov.

Vertex of head flat, the margins moderately laminately reflexed, about as long as pronotum and scutellum together, the anterior margin broadly rounded, the lateral margins slightly sinuate before eyes, ocelli near base, nearer to eyes than to each other, eyes posteriorly elongate ; face concave, moderately convex on the apical area ; pronotum short, deflected from base, scarcely longer than scutellum, distinctly foveate before each lateral margin, anterior margin centrally truncate, posterior margin angularly concave before base of scutellum ; scutellum broader than long, posteriorly deflected from base, the apex acute ; tegmina with the veins prominent ; posterior tibiæ four-cornered, curved, armed with numerous spines, the outer edge slightly expanded, and strongly spinous.

Type, *L. spatulata*, Dist.

In the enumeration of the Indian species this genus may follow *Petalocephala*.

#### *Ledrotypa spatulata*, sp. n.

♀. Somewhat uniformly dull ochraceous ; a short black fascia between and outside the anterior and intermediate coxæ ; vertex of head very finely and obscurely punctate, its posterior margin levigate ; pronotum with the disk very finely transversely striate, foveate on each side a little behind anterior margin, very obscurely centrally longitudinally impressed ; scutellum with a transverse impressed line before apex ; posterior tibiæ a little curved, with numerous somewhat remote fine spines on outer margin.

Long., incl. tegm., 11 mm.

*Hab.* "Himalayas" (Brit. Mus.) ; Bhogaon, Purneah Distr., N. Bengal (*Paiva*, Ind. and Brit. Muss.).

#### *Ledrotypa greeni*, sp. n.

Body and legs brownish ochraceous ; (abdomen mutilated) ; tegmina pale ochraceous, the veins darker and with piceous markings which consist of two long subcostal linear streaks, four similar streaks (three short and one long) on subapical area, the lowermost streak followed by one or two

small rounded piceous spots; vertex of head very finely and obscurely punctate, the apex a little more angulate than in the preceding species, traversed by two central, longitudinal, somewhat obscure impressions; pronotum very obscurely transversely striate; tegmina with the veins subprominent; wings hyaline, with the veins ochraceous.

Length, incl. tegm., 11 mm.

*Hab.* Ceylon (*Green*).

This description is based on a somewhat mutilated specimen sent to me by Mr. Green. It is to be readily separated from *L. spatulata* by the less concavely sinuate lateral margins of the vertex and by the piceous markings to the tegmina.

#### AMBERBAKIA, gen. nov.

Vertex of head not so long as pronotum and scutellum together, but a little longer than pronotum, the lateral margins gradually narrowed from in front of eyes to apex, which is subangulate; ocelli near lateral margins a little in front of eyes; head beneath very foliaceous, face widened and thickened between the antennæ, thence anteriorly elongately much narrowed and centrally sulcate, and posteriorly less narrowed to clypeus; pronotum a little shorter than vertex, its lateral margins straight, anterior margin straight but obliquely recurved behind eyes, posterior margin concavely sinuate; scutellum almost as long as pronotum; legs moderately slender, posterior tibiæ moderately curved, very long, and outwardly somewhat closely longly spinose; tegmina broad, costal and apical margins rounded, clavus broad, with transverse veins on its basal area, two elongate discoidal areas, and a series of transverse veins before apical area defining longitudinal apical cellular areas.

Type, *A. specularia*, Walk,

#### *Amberbakia specularia*.

*Petalocephala specularia*, Walk. Journ. Linn. Soc. Lond., Zool. x. p. 307 (1869).

Lateral areas of face at region of antennæ distinctly foveate.

*Hab.* New Guinea.

#### *Amberbakia bispecularis*.

*Petalocephala bispecularis*, Walk. Journ. Linn. Soc. Lond., Zool. x. p. 307 (1869),

Lateral areas of face at region of antennæ entire, not foveate.

*Hab.* Mysol.

*Penthimia mudonensis*, sp. n.

Body above castaneous ; vertex of head with the anterior and basal margins, a central longitudinal line, and the eyes black ; scutellum with three ochraceous spots, one near middle of each lateral margin and the third apical ; margins of clavus narrowly black ; more than apical third of tegmen dull ochraceous, tessellated with black cellular rings varying in size, prominent of which are spots in frontal margin of the apical area continued up the lateral margin of tegmen ; at extreme apex the colour is greyish, semiopaque, with a blackish spot in the apical cells ; body beneath castaneous ; face, cheeks, clypeus, disk of sternum, suffusions to femora, and transverse central basal spots to abdomen beneath black ; vertex of head convexly rounded in front, in length nearly half the breadth between eyes ; pronotum convex, wrinkled transversely ; posterior tibiæ longly strongly pilose.

Long.  $5\frac{1}{2}$  mm.

*Hab.* Tenasserim ; Mudon-Amherst Distr. (*Annandale*, Ind. Mus.).

A distinct species by the three pale spots to the scutellum, the large tessellate apical area to the tegmina, the short vertex, &c.

*Penthimia nitida*, sp. n.

Head, pronotum, scutellum, and tegmina (excluding apical area) shining black, apical area of tegmen greyishly subhyaline, outwardly and inwardly ochraceous, more or less extending upward to the opaque black area ; body beneath black, the legs ochraceous, anterior femora basally suffused with black ; head rounded in front, the anterior margin somewhat acutely reflexed ; pronotum moderately convex, slightly wrinkled, and sparingly coarsely punctate ; scutellum opaquely black, thickly finely punctate ; tegmina (excluding apical area) coarsely punctate ; posterior legs suffused with black, posterior tibiæ strongly spinose, the tarsi ochraceous.

Long. 4 mm.

*Hab.* Burma ; Moulmein (Brit. Mus.).

A species to be recognized by the strongly punctured upper surface ; it may be placed near *P. erebus*, Dist.



*Vulturnus ornatus*, sp. n.

Vertex pale ochraceous, finely speckled with brownish; pronotum very pale castaneous, thickly blackly reticulate, the posterior margin and a central transverse fascia greyish white; scutellum ochraceous, with black reticulations, which are more dense near basal margin and less so on lateral areas; body beneath (including face) and legs black; basal margin of head beneath between eyes, anterior and intermediate tibiæ and tarsi, minute spots to posterior tibiæ, bases and apices of posterior tarsi, and a lateral marginal spot to metasternum ochraceous; tegmina ochraceous, finely blackly reticulate, clavus with a discal black patch enclosing about four small white spots, its apex also whitish; a large central, longitudinal, costal white spot, which contains two small black spots and is followed by a larger black spot, and a cluster of subapical white spots; vertex a little broader than long, with an indistinct central longitudinal carination.

Long., incl. tegm., 4 mm.

*Hab.* Ceylon; Peradeniya (*Green*).

*Vulturnus speciosus*, sp. n.

Vertex ochraceous; a black submarginal apical line not reaching eyes, and with three testaceous discal spots, the central one transverse, the other two shorter and oblique; eyes black; pronotum ochraceous or very pale castaneous, thickly blackly reticulate, the posterior margin and a central transverse fascia greyish white; scutellum piceous, with four greyish-white spots, two before apex and two near basal margin; body beneath (including face) and legs black; basal margin of head beneath containing a few minute dark spots and anterior and intermediate tibiæ and tarsi ochraceous; tegmina ochraceous, finely, thickly, blackly reticulate, a small black patch in clavus containing about three white spots, some white spots on claval suture, a small white spot on disk of tegmen, three whitish spots on costal margin, and a small cluster of subapical white spots; vertex slightly longer and a little more narrowed anteriorly than in *V. ornatus*, with a central dark incised line extending from base about halfway to apex.

Long., incl. tegm.,  $3\frac{1}{2}$  mm.

*Hab.* Ceylon; Peradeniya (*Green*).

*Haranga borneensis*, sp. n.

Black, more or less finely punctate; membrane bronzy

brown, with the apex and some obscure spots greyish ; body beneath and legs black or piceous ; eyes piceous ; pronotum distinctly transversely wrinkled ; scutellum reaching apex of clavus, somewhat obliquely depressed at basal area, punctate, wrinkled, the apical area longitudinally ridged ; corium somewhat thickly punctate ; face strongly compressed behind eyes ; spinules to the posterior tibiæ long and prominent.

Long. 9 mm.

*Hab.* Borneo ; Kuching (*Hewitt*, Brit. Mus.).

Allied to the Indian species *H. orientalis*, Walk., from which it differs by the considerably more acute apex of the face, more strongly wrinkled pronotum, &c.

*Vangama? tuberculata.*

*Prolepta? tuberculata*, Walk. List Hom., Suppl. p. 315 (1858).

This species, described by Walker in the Fulgoridæ, really belongs to the Jassidæ, and can apparently be included in my genus *Vangama* (Faun. B. I., Rhynch. iv. p. 260).

*Hab.* N. China.

*Ledropsis singalensis*, n. nom.

*Ledropsis maculata*, Dist. Faun. B. Ind., Rhynch. iv. p. 181 (1907), nom. præocc.

LVII.—On the Structure of *Stromatoporoids* and of *Eozoon*.  
By R. KIRKPATRICK.

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[Plates XI. & XII.]

IN last month's 'Annals' I published a paper proving that *Stromatoporoids* and *Eozoon* were Foraminifera. It was there pointed out that they had a calcareous chambered skeleton, with the walls of the chambers penetrated by tubuli, and that there were present in the canals hoops and rings similar to those of recent Perforate Foraminifera. Further, I figured a coiled Foraminiferan shell in one of the chambers of *Eozoon*. So far my evidence was not much in advance of that already given by Dawson and Carpenter. I had done nothing to unravel the bewildering complexity and confusion presented by the skeletal arrangement nor to explain how

these Eozoic and Palæozoic Foraminifera were related to those of later ages. I hope in this brief preliminary communication to show that a great advance has been made and that it is now possible clearly to recognize the plan of growth and organization, and to indicate with some degree of probability the relationships existing between the ancient and modern forms.

In my last paper I had stated that the stellate patterns or "astrorhizæ" so often found on the surface of Stromatoporoids could be accounted for by assuming that the outer ends of several mural tubuli became united to form one large orifice; but I soon discovered the incorrectness of this view, and at the same time suspected that the clue to the Stromatoporoid problem was to be sought in the astrorhizæ.

While examining a broken fragment of *Stromatopora* I carefully mapped out the exposed chambers as seen on a tangential surface, and here and there made out several series showing a concentric arrangement in relation to an astrorhiza. Then it occurred to me that we had hitherto viewed Stromatoporoids from a wrong aspect, viz. the vertical, whereas the horizontal or tangential aspect was the one which revealed the mode of growth. The coiled series of alternating chambers reminded me of *Orbitolites*, and soon it became clear that astrorhizæ were the central and circumambient chambers of a spiral system, and that the multiple systems must have arisen by budding in some way.

Prof. F. Römer\* had spoken of certain Stromatoporas from the Eifel with surface tubercles each having a hole at its summit leading down to the orifice of a small specimen of *Spirorbis omphalodes*. He surmised that the little creature prevented the growth of the *Stromatopora* layers, and so kept up its communication with the outside world. The *Spirorbis* was probably nothing but the central and circumambient chamber of a Foraminiferan. This particular *ὀμφαλὸς* might in a sense be compared with that of the temple of Apollo at Delphi in being the centre of the Stromatoporoid and the hub of its universe.

Curiously enough, G. Lindström makes a similar observation about a *Spirorbis* saving itself from death by keeping open a passage of communication †.

The whole plan of Stromatoporoid organization now became delightfully obvious. A polished slab of any *Stromatopora* revealed clearly the numerous systems of spirally arranged

\* Geol. Mag. 1880, vol. vii. p. 345.

† K. Svenska Vetensk.-Akad. Handl. 1870, vol. ix. no. 6, p. 8.

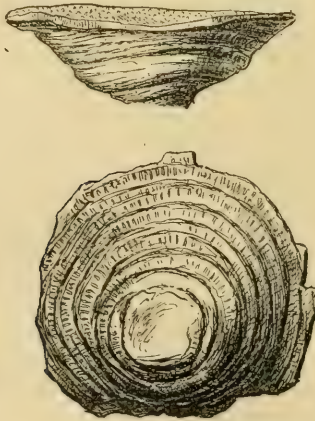
chambers, each system grouped round its central and circumambient chamber. Young specimens of *Labechia conferta* showed in the earliest stage a thin disk formed of forty or fifty spiral coils. Later the gradually ascending spiral led to the formation of a solid cone standing on its apex, and still later to the great hemispherical masses commonly met with.

Fig. 1.



*Orbitolites complanata*, Lamarek, showing central and circumambient chamber and succeeding spirals divided into segments.  $\times 35$ .  
(From Carpenter, 'Challenger' Report on *Orbitolites*, pl. vi. fig. 2.)

Fig. 2.



*Labechia conferta*. Silurian, Gothland. Young specimens: side view and view of under surface; spiral growth indicated. Natural size.

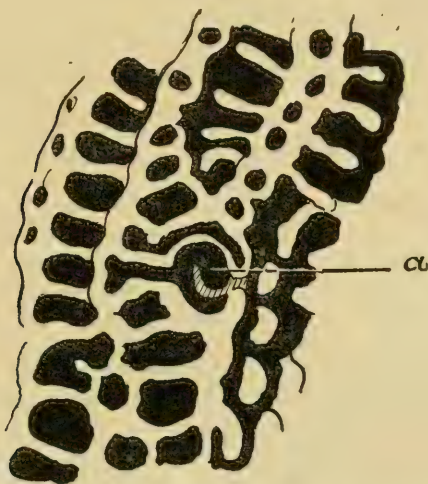
The extension in the horizontal plane partly takes place by the formation of a central chamber in the course of some particular coil, but mainly by the widening out of the spiral



systems already in existence. The formation of a new lamina is due to the budding upwards from an original central or "interpolated central" chamber, the bud becoming the centre of a new spiral. The peripheral series of chambers may become cyclical. In *Orbitolites* there is often a change from a spiral to a cyclical plan.

The small central chamber has a narrow straight neck, whence originates the circumambient chamber, and the latter continues the spiral and gives off radial offshoots. The sarcode following the circumambient chamber becomes segmented, owing to the formation of radial vertical partitions, and the outer walls increase in thickness.

Fig. 3.



*Clathrodictyon striatellum*, d'Orb. Wenlock. a, interpolated central chamber.  $\times 30$ .

A varying degree of complexity is brought about by the pressure of neighbouring spiral systems on each other and by the curving of successive laminae. Each lamina represents so many vertically produced buds, each with its system of spirals, and each latilamina marks a season of growth.

A vertical section of an *Actinostroma* cuts through so many coils, each coil being in relation to a central chamber. Sometimes a central chamber produces a wart or tubercle.

The branched forms (*Idiostroma*, *Stachyodes*) have only vertical budding along one axis.

One group of the Stromatoporoids, the Labechiidæ, appear to have a somewhat different type of central chamber from that of the rest, and the succeeding chambers are thinner-walled and more vesicular.

The sharp longitudinal ridges of *Beatricea* have each a little spiral system beneath the edge.

To sum up: Stromatoporoids are adherent colony-forming Perforate Foraminifera, each unit in one group of Stromatoporoids consisting of a central and circumambient chamber followed by spiral series of simple rather thick-walled chambers, with the walls perforated by pores and tubuli; here the growth is like that of the Imperforate genus *Orbitoides* (which has only vertical radial partitions, and not horizontal ones in addition, as in *Orbitolites*).

In another group—the Labechiidæ—the central chamber and immediately succeeding growth somewhat reminds one of the *Globigerina* type.

The Stromatoporoids are found in Ordovician, Silurian, and Devonian strata.

### *Eozoon.*

A vertical section of *Eozoon* shows an alternating series of wavy bands varying in appearance according to the varying mineral changes it has undergone. Commonly one finds white zones of calcite and yellowish translucent zones of olivine, which last may have undergone further changes into green serpentine.

The white zones of dolomite or secondary calcite constitute the “supplementary skeleton,” and are seen to be abundantly traversed by branching systems of canals. The yellowish or greenish zones are occupied by horizontal rouleaux of minute Nummulitid shells standing vertically, *i. e.* on their edges, and closely pressed against one another. Sometimes the peripheral edges of neighbouring shells overlap, and there may be here and there an appearance of a continuous spiral, but in reality the arrangement is like that of a rouleau of coins or flat disk-like beads strung on a string. Each shell has a funnel-like umbilicus through which the main stolon passes, and around which each coiled shell grows. In addition, minute shells appear to be budded off promiscuously from other stolon-like offshoots than the main central one. Each rouleau forms a common supplemental chamber, which communicates with its neighbours through circular orifices in diaphragms. Each coiled shell (or coin of a rouleau) has radiating septa and rows of pores in its thin primary wall.

Accordingly *Eozoon canadense* is a colonial Perforate Foraminiferan, each unit being a coiled shell of the Nummulitid type. There are no alar prolongations as in *Nummulites* \*.

### Classification of Stromatoporoids.

The current classification, that of Nicholson, is based on the theory that Stromatoporoids are Hydrozoa, and naturally needs revision. My work is not sufficiently advanced to enable me to make any other than a few general remarks.

The first point to notice is that these ancient Foraminifera are all colonial forms which frequently form massive blocks.

Murchison and Lindström mention the thick strata, the pillars, and huge balls composed mainly of *Stromatopora discoidea* to be found at Gothland, and Dupont calls attention to the fact that these organisms enter largely into the formation of the Devonian limestones of Belgium. The Stromatoporoids and *Eozoon* were, in fact, reef-forming Foraminifera.

These colonies of Foraminifera represent a simpler type than is found at present, when most of the Foraminifera exist as separate individuals, though it is not improbable that some of the larger modern Foraminifera may be true colonies, and not merely individuals which have grown by extension of single segments in vertical and horizontal directions.

I believe *Eozoon* to be the ancestor of the Nummulitidæ and the Stromatoporoids to be the predecessors of some of the spirilline, rotalian, and acervuline Rotaliidæ.

In fitting these primitive colonial Foraminifera into Brady's system they should be placed at the head of their respective families, viz. Eozooninæ in the Nummulitidæ, and Stromatoporinæ and Labechiinæ in the Rotaliidæ. The colonial habit is not of the first importance from the systematic point of view. It is the unit which gives the clue to the affinities. Certainly the unit of *Eozoon* is a Nummulitid and that of *Stromatopora* Rotalian. In *Beatricea* I see central globular *Globigerina*-like chambers, but the general mode of growth suggests the acervuline type common among the Rotaliidæ.

### Eozoon. Geological and Biological Implications.

I find that Eozoonal specimens from N.W. Scotland, from Connemara, and from Central Europe (Prof. Gümbel) are

\* It may be pointed out, alar prolongations are only present in some subfamilies of Nummulitidæ, and not in all.

certainly genuine Foraminifera and not mineral pseudomorphs. Professors King and Rowney remark sarcastically \* :—“Eozonal rocks, we are certain, will turn out to be much more common than may be conveniently admitted.” I would say, in reply, the more the better, for then geologists will be able to map out the Archæan seas with more precision.

I shall be asked, and in a tone of irony, whether I have found any evidence of organic structure in the bombs from Monte Somma. I have found abundant evidence. I can see plainly in places the coils of little *Nummulites* and the regularly arranged pores on the surface of the broad edges of coils.

I propose to name this species, following the usual precedent, *Eozoon vesuvii*, sp. n.

These topographical names will help geological cartographers to draw their maps.

The Eozonal limestones lying over the fundamental gneiss apparently have had an almost world-wide distribution. Evidently the throat of Monte Somma was very deep. I see no difficulty in imagining an eruption tearing off fragments of Archæan limestone. They would be hurled up with planetary velocity and some of them deposited on ledges on the inner face of the already formed crater. The interior of a white-hot meteor may be intensely cold with the cold of interstellar space. Curiously enough, the surface of *Eozoon vesuvii* is incrustated with a *Melobesia* and also what looks like a Cheilostomatous Polyzoon. The latter, of course, is certainly not Archæan. Evidently the crater of Monte Somma was beneath the sea at one time, so that the bomb became overgrown with marine organisms of relatively recent date.

Now we know for certain that the Lower Laurentian limestones of Canada are marine deposits formed from the skeletons of animals and plants, does not this fact give some support to the view that the bands of gneiss between which the limestone is sandwiched may be of sedimentary origin, metamorphosed by both local and regional agencies? If it is not altogether presumptuous for one who is devoid of expert knowledge† to express an opinion concerning a problem

\* “On *Eozoon canadense*,” Proc. Roy. Irish Academy, vol. x. 1869, p. 512.

† Though devoid of expert knowledge, I have viewed several hundred square miles of Archæan country from the summit of Mount Marcy in the Adirondacks. This region is very similar to that of the Original Laurentian on the other side of the St. Lawrence. There are the same gneisses and limestones, and Mount Marcy itself is an intrusive tooth of gabbro.



about which the greatest experts differ, viz. the problem of the aqueous or igneous origin of many of the metamorphic rocks, I would state my belief in the aqueous origin in some cases. At the same time I recall the sandwiched layers of Miocene coral-reef and lavas in the Baixo Island near Porto Santo, which might in some respects be compared to Archæan Foraminiferal reefs and layers of rock (gneiss) of possible igneous origin. Whether it is possible or not for lava to become metamorphosed so as to resemble gneiss is apparently not definitely known.

The biological implications are of the deepest interest. The ancestor of *Eozoon* must have lived immeasurable ages before the appearance of its highly organized descendant. We may imagine that ancestor to have been a naked mass of sarcode, from the periphery of which reticulate pseudopods radiated out. This animal would have been more entitled to the poetic name of Dawn Animal than its descendant, which had travelled some distance along the road since the first glimmer of life's dawn. The real dawn rays (of animal life) were, may one say, the pseudopods of a shell-less Rhizopod (like the freshwater *Lieberkühnia*).

In the next stage towards *Eozoon* we have to imagine knots on a stolon each forming the centre of a coil, and, lastly, the formation round pseudopods of a highly elaborate secondary skeleton, enclosing the rouleau of coiled shells.

I wish to express my sincere thanks to my colleague Mr. W. D. Lang, who has taken the greatest trouble in furnishing me with abundant material from among the treasures under his charge.

Finally, I would express my deep regret that, owing to great pressure of work, I have been able to set forth this important communication only in a very disjointed fashion.

#### APPENDIX.

*Note 1.*—In my paper in the September 'Annals' I failed to do justice to Sir W. Dawson, the only investigator who definitely stated that Stromatoporoids and *Eozoon* were Foraminifera. I only noticed his remarks in 'The Dawn of Life,' where he supposes Stromatoporoids to be a connecting-link between Sponges and Foraminifera. But in the Quart. Journ. Geol. Soc. xxxv. pp. 48–66 (not seen by me at the

time) he distinctly records his opinion that they are Foraminifera, and even gives fairly good reasons for his faith; but he failed to convince his successors.

*Note 2.*—Recently I have examined a thick section of a specimen in my own possession labelled “*Favosites*, Wenlock.” I find that it is certainly not a *Monticuliporoid*. Accordingly I withdraw the statement I made to the effect that the genus *Favosites* comes within the *Monticulipora* group (*i. e.* siliceous sponges with supplementary calcareous skeletons).

*Note 3.*—In the ‘Annals’ for Sept. 1912 I also stated that *Eozoon* was allied to *Beatricea*. At that time I held the same views on *Eozoon* as Carpenter, and regarded the spaces formed by the secondary skeleton as huge vesicular chambers. Of course a space bounded by secondary skeleton and containing a rouleau of Nummulitid shells is in no way to be compared with one of the chambers of *Beatricea* with its thin curved roof of primary skeleton.

*Note 4.*—Both *Stromatoporoids* and *Eozoon* have laminated structure, and the weathered edges show the layers, which, however, have an entirely different origin. The edges of *Stromatoporoids* are those of horizontal coils of spiral chambers, but the edges seen in *Eozoon* are mainly those of the supplementary skeleton. The structures in *Eozoon* really corresponding to the edges of the layers of *Stromatoporoids* are the margins of the upright-standing Nummulitid shells arranged in horizontal rouleaux.

*Note 5.*—*Eozoon* must have grown in shallow seas and may have formed fringing reefs to continents. At the present day coral-reefs are distributed within the tropic and sub-tropic belt; but in the earliest times probably the waters of the globe were practically isothermal, just as in a kettle of water over the fire, the bottom of the kettle representing the thin consolidated crust of the earth. When the internal heat was withdrawn owing to thickening of the crust, the outside meteorological influences would set up the various isothermal zones at present existing.

Seeing that we now know definitely that Archæan limestones were of organic origin, it does not seem unreasonable to assume that the bands of gneiss below and above them

were sedimentary deposits. Possibly future geologists will be comparing the successions of strata in Eozoic cretaceous rocks with those of the Mesozoic cretaceous series.

*Note 6.*—Amidst the hurry of preparations for my departure on a fourth expedition to Porto Santo Island to work out the *Monticulipora* problem *ab ovo*, I omitted to mention that I had found three Coralline algæ on a block of *Eozoon canadense*, viz. (1) an incrusting pluristromatic *Melobesia*, (2) a jointed *Corallina* with terete internodes, and (3) a *Penicillus*-like form with broad basal internodes and elongated tufted terminal internodes. I propose to name the first provisionally *Melobesia canadensis*, the second *Corallina teretiformis*, and the third *Eopenicillus auroræ*. We may now be certain that *Eozoon canadense* lived in the Coralline zone.

I hope that on my return in October the authorities will permit me to describe and figure the members of the Eozoic fauna referred to in this paper, viz. *E. canadense*, *E. vesuvii*, *E. bavaricum*, *E. scoticum*, and *E. erinense*.

The *Eozoon* problem is mainly a Foraminiferal one. Some of those who have attacked it have evidently had no knowledge of Foraminifera. I hope the present paper will have the effect of breaking through the crust of petrological prejudice which for nearly fifty years has misled the scientific world with regard to an important question.

*Note 7.*—The difference in construction between *Eozoon* and the Stromatoporoids is due to the laying down of a secondary skeletal deposit by the former. A typical *Stromatopora* may be compared to an inverted laminated pyramid in which the succeeding layers rapidly spread out widely in the horizontal plane, so that the pyramid does not topple over sideways. In *Eozoon*, on the other hand, the coils succeeding the first flat disk remain small, being unable to spread out owing to deposition of secondary skeleton. Soon the little pile or tower of disks leans or topples over, and the disks now form horizontal rouleaux of vertically arranged disks, *i. e.* of disks standing on their edges.

The Stromatoporoids form horizontal laminæ made up of disks or coils lying on their flat surfaces, and being unhampered by secondary deposits the coils may grow to a very large size. The original cause of the formation of the supplementary skeleton in *Eozoon* probably lay in the greater abundance of lime-salts in certain areas of the Eozoic seas, leading to deposition of thick secondary deposits outside the primary shells.

*Note 8.*—The discovery of the primitive colonial Foraminifera will probably shed much light on the origin of dimorphism (see J. J. Lister, Phil. Trans. 1895, vol. 186, p. 401, and F. W. Winter, 'Protistenkunde,' vol. x. 1907, p. 1). The colonial habit gave way to the individual one possibly owing either to the breaking off of the buds or to premature blocking up of the main gemmiparous stolon by calcareous deposit. In either case injury or damming up might lead to endogenous division. The vegetatively formed megalospheric shell would then have become a gamont producing isogametes. Conjugating isogametes would form a young microspheric agamont, which, by agamogony, would form agametes, each of the latter becoming a young megalospheric gamont.

Winter writes (*l. c.* p. 106):—"halte ich es für höchst wahrscheinlich, dass Dichromasie und Dimorphismus derselben allen Thalamophoren zukommt." I think this condition has arisen owing to the repression of the original primitive colonial habit giving rise to a simple sexual phase, the latter recurring to a vegetative phase. In the text of this paper I pointed out that in addition to the large buds formed on the main axial stolon there were often little buds formed on any part of a coiled shell. I think these little buds are almost certainly megalospheric, but I am not at present certain.

*Note 9.*—The great prevalence of an organism at a certain epoch followed by its almost total disappearance constitutes a very strange phenomenon in evolution. About the Eocene epoch, for instance, the Nummulites flourished amazingly and carpeted sea-floors over vast areas along a great belt extending across the Eurasian continent from Spain to the north-east corner of Asia. Nummulites were mostly heavy benthos organisms living in shallow seas, the latter probably covering rising areas. At the very summit of a Himalayan peak 19,000 feet above sea-level we find an Eocene sea-floor composed mainly of Nummulites, the sea-bottom having been gradually elevated by lateral thrust. (Figures of this limestone are given in the Natural History Museum Guide to the Coral Gallery.) During the Cretaceous epoch and over hundreds of millions of square miles of ocean at the present day a surface- or plankton-Foraminiferan, viz. *Globigerina*, has largely contributed to the formation of thick deposits of *Globigerina*-ooze.

*Note 10.*—It seems to be legitimately within the limits of the subject of this paper to consider why a primitive Rhizopod



like *Eozoon* should have a calcareous skeleton and why other Rhizopoda should have a siliceous one.

I think we must go back to the cooling mineral magma, which would vary greatly in character over different areas and which would form shallower or deeper troughs. Probably at first, before diffusion produced more or less uniformity, seas filling those troughs would vary in composition. Rocks are classified as acid or basic according to the percentage of silicic acid present in them, and similarly a classification based on mineral constituents might have been extended to primitive seas (just as doctors classify mineral waters). Sarcode living in seas with a high percentage of silica and a small one of calcium salts would become saturated with the former mineral. Apparently silica forms a more intimate union with protoplasm than carbonate of lime does, and, though isotropic when thus united, seems to impress some of its mineral characters on that protoplasm, as witness the beautiful symmetry of Radiolaria and of Hexactinellid spicules\*. Acanthin of Radiolaria seems to be halfway between silica-saturated protoplasm and silica of the skeleton.

Organisms with skeletons of silica, probably on account of their want of flexibility, have only travelled a short distance along the path of evolution. The calcareous animal organisms, on the other hand, have deposited their skeletal material in masses (acicula, dorsal pillar, limb-girdles, &c.) which have served as *points d'appui* for contractile protoplasm, and thus they have been enabled to come into relation with a varied environment. Consequently the path of evolution from the Dawn Animal to human civilization has been along the calcareous way.

\* For some time past I have thought that possibly sponges are triphyletic and that there were at least three ancestral olynthus (and not one olynthus), viz. a shallow-water calcareous, a shallow-water pre-Demosponge, and a deeper water Hexactinellid olynthus, all three originating from colonial *Totora*-like Flagellates or Choanoflagellates. In all three a free-swimming phase would be followed by a fixed one brought about by the increasing disproportion between weight and carrying capacity. On coming to rest the little organism would form a disk with an inferior layer of granular cells and a superior layer of flagellate cells. The increasing growth of the lower nutritive layer would soon cause it to encompass the upper motile layer, which would sink into it and an olynthus would be formed.

The Choanoflagellate pre-Hexactinellid was highly vacuolated and its delicate reticulate strands would be best sustained by a type of spicule having three axes crossing a common centre at right angles, like building scaffolding, and the loose-textured protoplasmic network would permit of the formation of large flagellated chambers. (I would add that I hold this homiousion heresy very lightly.)

*Note 11.*—The umbilicus of each Nummulitid shell or coil of *Eozoon* corresponds to the astrorhiza of Stromatoporoids. The umbilicus is funnel-shaped, being broad at the proximal end and reduced to a small pore at the distal. To obtain in *Eozoon* the same appearance as is seen on the surface of *Stromatopora* it is necessary to cut a vertical section in the plane of the flat surfaces of the Nummulitid shells. In *Eozoon* each coil would be found to be small and surrounded by a zone of supplementary deposit. The dark radial streaks of the astrorhizæ of Stromatoporoids are probably the expression of the thick masses of sarcode (? with iron) in the grooves between surface-tubercles of the coils of chambers.

*Note 12.*—Possibly the little “buds” seen on the Nummulitid shells of *Eozoon* may result from a process of agamogony. See the beautiful figures of *Peneroplis pertusus* in F. W. Winter’s remarkable study of the Thalamophoren (‘Pro-tistenkunde,’ x. 1907, p. 1, pl. i. fig. 1). Probably thin sections of *Eozoon* will reveal some very interesting facts.

*Note 13.*—The rouleaux of Nummulitid shells are serpentine in a double sense. The existence in *Eozoon* of bands of dolomite or secondary calcite alternating with bands of olivine or serpentine results, I think, from the following causes:—The supplementary skeleton (calcite or dolomite) originally formed masses of pure calcite with very little protoplasm in it, but the coils of shells were full of protoplasm containing metallic compounds. There would be a great difference in the molecular changes and affinities in the primary and secondary skeletons, and in the former the silica would much more easily combine with the iron-magnesian compounds to form olivine. The reasonableness of this theory is shown by the fact that the canal-system permeating the secondary skeleton is wonderfully preserved in olivine and can be etched out by dissolving the calcite.

*Eozoon* may be regarded as a marvellous nature-print by Nature herself, and one beside which the most refined products of human art are clumsy, for the finest details of the structure of the skeleton have been preserved. During each “process” the parts have been changed molecule by molecule. It is true the resulting work of “art” has been woefully damaged in the case of *Eozoon vesuvii*, *E. bavaricum*, &c. by later rough treatment, such as heat, pressure, and crumpling.

In *E. vesuvii* the extra baking has converted the olivine into a serpentine almost resembling the granular Cornish kind, but the original Nummulitid pattern is still obvious.

In the presence of examples of *Eozoon canadense* with all the details of their structure so perfectly preserved it is amazing to think that they lived at a time so distant that even the Cambrian epoch with its highly organized fauna does not seem very remote.

*Note 14.*—In each colony of *Eozoon* the horizontal rouleaux radiate outwards from a dense vertical central sheaf composed of strings of small Nummulitid shells without secondary skeleton or with only very little.

At a time when I was deluded by theories of pressure and by serpentine *ignes fatui*, I had thought that this dense central conical column or sheaf, seen in vertical sections through the centre, was produced by a crushing-in force. The resemblance between *Eozoon* and, say, *Stromatopora concentrica* is now seen to be very close. Each may be compared to a huge hemispherical mushroom with a very small stem. In *Eozoon* the main body is composed of small disks limited in size owing to secondary deposit. In *Stromatopora* the usually larger coils or disks are not thus limited. Again, in its plume-like upward and outward growth the Dawn Animal may be compared to a fountain.

## EXPLANATION OF THE PLATES.

### PLATE XI.

- Fig. 1.* *Stromatopora hiipschii*, Barg. Devonian, Teignmouth (P. 6328.) Polished slab. Tangential view, showing spiral systems. Nat. size.
- Fig. 2.* *Hæmatostroma episcopale*, Nich. (P. 5690) Polished slab. Tangential view, showing spiral systems and central chambers. Nat. size.
- Fig. 3.* *Actinostroma hebbornense*, Nich. Mid-Devonian, Teignmouth. A spiral system.  $\times 6$ .
- Fig. 4.* *Labeckia conferta*, Lonsdale. Very young specimen, showing thin disk with coils.  $\times 2$ .

### PLATE XII.

- Fig. 5.* *Eozoon canadense*, Dawson. Vertical section, showing alternating light layers of calcite (supplementary skeleton) and dark layers (which contain piles of Nummulitid shells). Nat. size.
- Fig. 6.* *Eozoon canadense*. Layers of coiled Nummulitid shells. The calcareous supplementary skeleton has been dissolved by acid. The shells lie in rouleaux in the green areas (olivine and serpentine) bounded by the supplementary skeleton.  $\times 25$ .
- Fig. 7.* *Eozoon canadense*. A single apparently broken-off Nummulitid shell, showing funicular umbilicus.  $\times 190$ .

- Figs. 8 A, 8 B. Eozoon canadense.* Vertical sections, showing Nummulitid shells mostly laid open, but partly (in fig. 8 B) showing thin outer walls and pores. *a* (in fig. 8 A), stolon uniting four shells and passing through infundibulum in each shell.
- Fig. 9. Eozoon canadense.* Vertical section at and near surface, showing supplementary canal-system ramifying in supplementary skeleton and pseudopodia (in olivine) forming a branching network outside the specimen; at base five large Nummulitid shells, with their surfaces ground down, so that the shells are opened.  $\times 12$ .

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- (1) *Annales Scientifiques de l'Université de Jassy.* Tome vii. 3<sup>me</sup> Fascicule. Juillet 1912.
- (2) *Smithsonian Institution, U.S. Nat. Mus. Bulletin 76. Asteroidea of the North Pacific and Adjacent Waters.* By WALTER KENRICK FISHER, Assistant Professor of Zoology, Stanford University, California. Part I. *Phanerogamia and Spinulosa.* Washington, 1911.
- (3) *Proceedings of the Washington Academy of Sciences.* Vol. xiii. 1911.
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# CONTENTS OF NUMBER 58.—*Eighth Series.*

	Page
XLVIII. Notes on Fossorial Hymenoptera.—X. By ROWLAND E. TURNER, F.Z.S., F.E.S. ....	361
XLIX. The Osteology and Classification of the Teleostean Fishes of the Order Apodes. By C. TATE REGAN, M.A. ....	377
L. A Revision of the South-American Characid Fishes of the Genera <i>Chalceus</i> , <i>Pyrrhulina</i> , <i>Copeina</i> , and <i>Pogonocharax</i> . By C. TATE REGAN, M.A. ....	387
LI. On a Collection of Small Mammals from the Tsin-ling Mountains, Central China, presented by Mr. G. Fenwick Owen to the National Museum. By OLDFIELD THOMAS ....	395
LII. New Bats and Rodents from S. America. By OLDFIELD THOMAS ....	403
LIII. New Land and Freshwater Shells collected by Dr. J. Elbert in the Malay Archipelago. By Dr. F. HAAS, Frankfurt-a.-M. ....	412
LIV. Descriptions of new Reptiles from the Andes of South America, preserved in the British Museum. By G. A. BOULENGER, F.R.S. ....	420
LV. A Contribution to the Knowledge of the Fauna of <i>Bromeliaceae</i> . By HUGH SCOTT, M.A.(Cantab.), F.L.S., F.E.S., Curator in Entomology in the University of Cambridge. Including Descriptions of new Insects by W. L. DISTANT, F.E.S., and the late R. SHELFOED, M.A., F.L.S. (Plate X.) ....	424
LVI. Descriptions of some new Homoptera. By W. L. DISTANT. ....	438
LVII. On the Structure of Stromatoporoids and of <i>Eozoon</i> . By R. KIRKPATRICK. (Plates XI. & XII.) ....	446

## BIBLIOGRAPHICAL NOTICE.

Recent Foreign and Colonial Natural History Periodicals .....	460
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LVIII.—*Notes on the Apidæ (Hymenoptera) in the Collection of the British Museum, with Descriptions of new Species.*  
By GEOFFREY MEADE-WALDO, M.A.

(Published by permission of the Trustees of the British Museum.)

I. Subfamily *MEGACHILINÆ*.

THE following notes were made during a recent rearrangement and expansion of the bees of this subfamily.

A considerable number of types have, of necessity, come under notice during this work, and the fact that many of the species have been either ignored or misunderstood by other workers has made the present appear a good opportunity in which to make an effort to facilitate the identification of these species by means either of keys or notes on synonymy.

The species which appear to be least understood are those described by the late Frederick Smith, and to these special attention has been paid. Much valuable information has already been published on the British Museum collection of bees, notably by Prof. T. D. A. Cockerell in his paper "Notes on some Bees in the British Museum" (Trans. Amer. Ent. Soc. xxxi. p. 309, 1905), and by A. Ducke (Deutsch. ent. Zeitschr. p. 362, 1910). Friese's valuable monograph of the subfamily ('Das Tierreich,' 28 Lieferung) has been of great assistance.

As Prof. Cockerell rightly remarks (*l. c.* p. 309), Smith's descriptions, though good for the time when they were written, are inadequate for modern requirements, since the number of described species has so vastly increased.

The types of all the new species here described are in the British Museum.

My best thanks are due to Professor Poulton, F.R.S., for the loan of Wallace's Malayan *Megachile* described by F. Smith, the types of which are in the Hope Department of the Oxford University Museum.

## ERIADES, Spin.

### *Eriades rugifrons*, Smith.

This species was described as *Chelostoma rugifrons* (Catal. Hymen. Brit. Mus. ii. p. 220, 1854) from Georgia, U.S.A.

In his description Smith makes no mention of the clypeus, which is very similar to that of *Megachile* subgenus *Eumegachile*: *i. e.*, very short, much broader than long, broadly emarginate, and laterally provided with blunt tubercles. The length given (5 lines) is an underestimate, the correct length is 13 mm. The insect has a superficial resemblance to *E. grandis*, Mor., the form of the clypeus being very similar.

## OSMIA, Panz.

There are but few types of this genus in the British Museum collection. Smith described three species from the Angara River, Siberia, which may be separated as follows:—

- |    |   |  |                     |
|----|---|--|---------------------|
| 1. | { | Legs entirely black, robust insect. L. 11 mm.  | <i>ephippiata</i> . |
|    |   | Legs partially ferruginous, more slender insects. 2.   |                     |
| 2. | { | Legs ferruginous (coxæ and trochanters black), thorax clothed with fulvous pubescence, abdominal tergites with lateral fasciæ of pale pubescence, scopa pale fulvous. L. 9 mm. | <i>rubripes</i> .   |
|    |   | Tarsi ferruginous, thorax clothed with black pubescence, abdominal tergites with lateral fasciæ of rich golden pubescence, scopa golden. L. 13 mm. ....                        | <i>rufitarsis</i> . |
|    |   |  |                     |

*O. ephippiata* is a *Melanosmia*, Schmied., very near *O. pilicornis*, Sm., but with the abdomen wholly black-haired. The vertex and thorax are clothed with *ochraceous* pubescence (*teste* Smith's original description), not reddish yellow (rotgelb) as stated by Friese ('Das Tierreich,' Lief. 28, p. 130).

*Osmia rubripes* is very near *O. rufohirta*, Lep., and belongs to the subgenus *Acanthosmia*, Thoms.

*Osmia laboriosa*, Sm., from Yarkand, somewhat resembles *O. rufigastra*, Lep., from Algeria, but differs in having the scape, mandibles, and anterior margin of the clypeus reddish, whereas in *O. rufigastra* all these parts are black. Cockerell (Trans. Amer. Ent. Soc. xxxi. p. 333, 1905) writes a note on the species. The black markings on the abdomen give the insect a very distinct appearance. The North American species are satisfactorily dealt with by Cockerell.

*Osmia jucunda*, Smith.

*Osmia jucunda*, Smith, Catal. Hymen. Brit. Mus. i. p. 139. no. 36 (1853). ♀.

*Osmia vidua*, Gerst. Stettin. ent. Zeit. xxx. p. 345. no. 9 (1869). ♂ ♀.

Smith's type of *O. jucunda* from Albania agrees perfectly with specimens determined by Friese in the Edward Saunders collection. Gerstaecker described his species from Sicily.

*Osmia apicata*, Smith.

*Osmia apicata*, Smith, Catal. Hymen. Brit. Mus. i. p. 140. no. 37 (1853). ♀.

*Osmia macroglossa*, Gerst. Stettin. ent. Zeit. xxx. p. 349. no. 12 (1869). ♂ ♀.

Smith's type of *O. apicata* agrees perfectly with specimens in the Edward Saunders collection determined as *O. macroglossa* by Friese, and with a specimen from Corfu determined by Schmiedeknecht. In his 'Apidæ Europææ,' Schmiedeknecht suggests that they are co-specific, but does not synonymise them, being unable to determine *O. apicata* satisfactorily from the description.

LITHURGUS, Latr.

*Lithurgus rotundipennis*.

*Megachile rotundipennis*, W. F. Kirby, Monograph of Christmas Island, p. 87 (1909).

This species from Christmas Island, Indian Ocean (*C. IV. Andrews*), is a typical *Lithurgus*.

*Lithurgus scabrosus*.

*Megachile scabrosus*, Smith, Journ. Linn. Soc., Zool. iii. p. 134. no. 2 (1853).

Type in the Hope Department, University Museum, Oxford. In the British Museum there are specimens from

Rarotonga (*Wyatt-Gill*), Celebes (*Ida Pfeiffer*), and Amboyna (*F. Muir*).

MEGACHILE, Latr.

*Megachile albopicta*, Smith.

*Megachile albopicta*, Smith, Catal. Hymen. Brit. Mus. i. p. 154 (1853).  
♀.

*Megachile flabellipes*, Pérez, Espèces Nouv. Mellifères Barbarie, p. 23 (1895). ♂ ♀.

Both described from Algeria, and evidently co-specific. *M. flabellipes* has the scopa rather more golden than *M. albopicta*, but the latter is probably a rather faded specimen.

*Megachile ceylonensis*, Bingham.

*Megachile ceylonensis*, Bingham. Proc. Zool. Soc. Lond. p. 453, pl. xv. f. 9 (1896). ♂.

The male of this species from Pundaloya, Ceylon (*E. E. Green*), is the type. The species is recorded as "*M. ceylonica*" in the Fauna Brit. India, Hymen. vol. i. p. 482: through an oversight, as it is correctly named in the key to the species (*l. c.* p. 472). The insect from Tenasserim described as the female of *M. ceylonensis* can have no affinity with it, and is totally different in appearance, so that the description of the male given in the 'Fauna of India,' Hymenoptera, vol. i., is misleading, since no mention is made of the most conspicuous character in the coloration of the abdomen.

A new name is thus necessary for this sex:—

*Megachile caroli*, nom. nov.

*Megachile ceylonensis*, Bingham. Fauna Brit. India, Hymenoptera, vol. i. p. 482 (1897).

The species is quite adequately described (*l. c.*).

*Megachile stulta*, Bingham.

*Megachile stulta*, Bingham. Fauna Brit. India, Hymenoptera, vol. i. p. 476 (1897). ♂ ♀.

This is certainly a composite species, and the female must be considered the type of *Megachile stulta*, Bingham.

The specimen marked by Bingham as his type of the male from Bangalore, S. India, agrees very well with a specimen from Dehra Dun, United Provinces, determined by Dr. R. C. L. Perkins as *M. schauinslandi*, Alfken, described from



Honolulu (Entom. Nachrichten, xxiv. p. 340 (1898), ♀). It would not be advisable, however, to synonymise these two species without examining the type of *M. schauinslandi*. In addition to this, the male of Alfken's species is as yet undescribed.

The description given by Bingham of the insect he considered to be the male of *M. stulta* in no way agrees with the specimen itself, and is misleading. From the description (*l. c.*) one would expect to find a black insect, the abdomen covered with ferruginous-red pubescence, more sparse than in the female, in which the abdomen is altogether covered with a ferruginous-red pile. In colour the male belongs to the *lanata* group, and has the first abdominal segment alone with any considerable clothing of ferruginous pubescence, although segments 2 and 3 bear narrow fasciæ; in the terminal segments the fasciæ of ferruginous pubescence give way to white.

*Megachile bellula*, Bingham.

Bingham describes both sexes of this species (Fauna Brit. India, Hymen. i. p. 476, 1897). In the Museum there are two specimens labelled as "*M. bellula*, Bingham, ♂," one of which is designated as the type. The species is certainly composite, the true male of *M. bellula* being the insect so labelled by Bingham, but *not* described. The name must be retained for the female, which becomes the type. The other male, labelled as type ♂ of *M. bellula* and described (*l. c.*), must be renamed

*Megachile (Eumegachile) binghami*, nom. nov.

*Megachile bellula*, Bingham. Fauna Brit. India, Hymen. i. p. 476, fig. 158 (1897). ♂.

*Hab.* Rangoon, Burma, vi. 1887 (type) (nec ♀); Yé Valley and Amherst, Tenasserim (*Bingham Coll.*).

This species is adequately described (*l. c.*). The sixth abdominal segment is provided with a distinct longitudinal carina, which is well shown in the text-figure.

There is also a series of five females from various localities in Tenasserim of an insect which is doubtless the true female of *M. binghami*.

♀. Head and thorax black, abdomen entirely clothed with rich reddish-brown pubescence, scopa reddish brown. Legs black, posterior tarsi reddish on the inner side. Head with thick, black pubescence, pleuræ with whitish pubescence of varying thickness. Wings fusco-hyaline. Clypeus very

short, broad, shallowly emarginate, with a slight longitudinal carina. Mandibles arched, 4-toothed. Posterior tibiae very coarsely punctured. Metatarsus iii. cylindrical, only half as broad as tibiae.

Length 15 mm.

The species can be separated from *M. bellula*, which is a *Megachile* sens. str., as follows :—

<i>M. (Eumegachile) binghami</i> , ♀.	<i>M. bellula</i> , ♀.
Face without white pubescence.	Face with white pubescence.
Wings fusco-hyaline.	Wings hyaline.
Metatarsus iii. cylindrical, half as broad as tibiae.	Metatarsus iii. as broad as tibiae.

The following characters serve to separate the males :—

<i>M. (Eumegachile) binghami</i> , ♂.	<i>M. bellula</i> , ♂.
Anterior tarsi simple.	Anterior tarsi dilated.
Thorax clothed with dark pubescence.	Thorax clothed with pale, golden-brown pubescence.
Abdomen entirely clothed with fulvous pubescence.	Abdominal segments with fulvous apical fasciae.
Abdominal segment 6 notched, with longitudinal carina.	Abdominal segment 6 simple, without longitudinal carina.

### *Megachile luculenta*, Bingham.

*Megachile luculenta*, Bingham. Journ. Bomb. N. H. Soc. p. 249 (1890).  
♀.

*Hab.* Tavoy, x. 1889 (type); Runjit Valley, Sikkim, v. 1894; Salween Valley, Upper Tenasserim, vii. 1892 and iv. 1893 (*Bingham Coll.*); Bhutan (*G. C. Dudgeon*).

It is necessary to revive this name, which has been made a synonym of *M. mystacea*, F. It is evident that Bingham has wrongly identified the Fabrician species (type in Banks Coll.) from Australia, though later he quite correctly remarks (*Trans. Zool. Soc.* p. 183, 1909) that *M. mystacea* has nothing to do with the African *M. (Eumegachile) rufiventris*, Guér.

*M. luculenta* is a considerably larger species, being 20 mm. in length, whereas *M. mystacea* is only 15 mm.

### *Megachile ornata*, Smith.

*Megachile ornata*, Sm. Catal. Hymen. Brit. Mus. i. p. 183 (1853).

*Megachile miniata*, Bingham. Journ. Bomb. Soc. x. p. 199, fig. 6 (1896).

Smith did not know the locality of this species at the time he described it, but has written in "Sumatra" in the

Museum copy of the catalogue at a later date. Bingham's type of *miniata* from Deli, Sumatra, agrees perfectly with it.

*Megachile bicaniculata*, Cam.

*Megachile bicaniculata*, Cam. Proc. Zool. Soc. ii. p. 35 (1901).

*Megachile caniculata*, Cam. MS.

The type of *M. bicaniculata* is from the Malay Peninsula (3000 ft.), that of *M. caniculata* from Kuching (Sarawak). It is possible Cameron discovered that they were the same species, since no description of *M. caniculata* appears to have been published.

*Megachile semivestita*, Smith.

*Chalicodoma semivestita*, Sm. Catal. Hymen. Brit. Mus. i. p. 148. no. 5 (1853). ♂.

*Megachile determinata*, Sm. Descr. New Spec. Hymen. p. 69. no. 26 (1879). ♀.

These are sexes of the same species, though described from such widely separated places as India and Java. A male from Java (Horsfield Coll.) agrees in every detail with the type.

*Megachile architecta*, Smith.

*Megachile architecta*, Smith, Journ. Linn. Soc., Zool. ii. p. 46. no. 6 (1857).

*Megachile tarea*, Cam. Journ. Straits Asiat. Soc. xxxvii. p. 124 (1902).

These two species are from the same type locality (Sarawak, Borneo). A comparison of Smith's type from the Hope Department of the Oxford University Museum with Cameron's type in the British Museum proves them to be identical.

*Megachile atrata*, Smith.

*Megachile atrata*, Smith, Catal. Hymen. Brit. Mus. i. p. 182. no. 112 (1853). ♀.

*Megachile fulvipennis*, Smith, Descr. New Spec. Hymen. p. 68. no. 22 (1879). ♀.

*Megachile viriplaca*, Cam. Journ. Str. Asiat. Soc. xxxvii. p. 119 (1902). ♂.

*Megachile shelfordi*, Cam. Journ. Str. Asiat. Soc. xxxvii. p. 124 (1902). ♀.

Widely distributed through the Malay Archipelago. The type (*atrata*) is from the Philippine Islands; Nicobars (*fulvipennis*); Borneo, Sarawak (*Shelford*) (*viriplaca* and

*shelfordi*) ; Sumatra ; Kota Raja, Achin, Puloweh (*Wallace, Meade-Waldo*) ; Tenasserim, Mergui (*Bingham*) ; Java (*Horsfield*) ; Singapore (*H. N. Ridley*).

*Megachile dimidiata*, Smith.

*Megachile dimidiata*, Sm. Catal. Hymen. Brit. Mus. i. p. 174. no. 88 (1853). ♀.

*Megachile velutina*, Sm. Catal. Hymen. Brit. Mus. i. p. 180. no. 105 (1853). ♀.

*M. dimidiata* (type in British Museum) has the pollen-brush deep fulvous in the centre and black laterally, *not* entirely black as Smith states; in his description of *M. velutina* he describes it correctly.

Bingham (Fauna Brit. India, i. p. 472) separates the two species on the colour of the antennæ and legs, which he says are fulvous red in *M. dimidiata* and black in *M. velutina*, although the original descriptions of both species distinctly state that the legs are fulvous, and specimens determined by Bingham himself as *M. velutina* have red antennæ and fulvous legs. The type of *M. velutina* was in the collection of the late J. S. Baly.

*Megachile rotundiceps*, Smith, ♀.

This species, described from Mt. Ophir (type in the Hope Department), belongs to the subgenus *Eumegachile*. The scopa is silver-white except sternite 5 (at the apex) and 6, where it is black.

*Megachile terminalis*, Smith, ♀.

As Friese rightly says, this species is like *M. ornata*, Smith, but differs in having the scopa black. Other differences, noticeable on comparing the types of the two species, are to be found in the considerably darker wings of *M. terminalis* and its slenderer form.

*Megachile placida*, Smith, ♂.

Described from Gilolo. The species has a slender, forward-curving spine on each of the anterior coxæ. Type in Hope Department.

*Megachile laboriosa*, Smith, ♂.

This species has a short tubercle on each anterior coxa. Type in Hope Department.





4. { Abdomen basally red, apically black; wings  
clear hyaline. L. 12 mm. (Natal.) .. *basalis*.  
Wings fusco-hyaline ..... 5.
5. { Thorax with dense rufous pubescence;  
abdomen covered with grey pubescence,  
densest on apical margin of segments,  
scopa whitish. L. 13 mm. (Gambia). *discolor*.  
(=*fülleborni*, Fr.)
6. { Thorax somewhat sparsely clothed with  
ochraceous pubescence, abdomen and  
scopa fulvous ..... 6.
6. { Metatarsus iii. flattened, abdominal tergites  
with broad apical fasciæ. L. 13 mm.  
(Cape of Good Hope.) ..... *eurymera*.  
Metatarsus iii. linear, fulvous pubescence  
more sparse towards apex. L. 16 mm.  
(Cape of Good Hope.) ..... *dorsata*.

The above species are not included in Friese's table of African *Megachile* ('Die Bienen Afrikas,' p. 327 *et seq.*), and though included in 'Das Tierreich,' Lief. 28, p. 274 *et seq.*, it seems that a further short table taken from the actual types is not superfluous.

Of the species not tabulated by Friese in his African monograph, *M. maculata* and *M. perplexa* are omitted here, as it has not been possible to identify the types, which were in the collection of the late W. W. Saunders.

#### *Megachile fervida*, Smith.

*Osmia fervida*, Sm. Catal. Hymen. Brit. Mus. i. p. 142 (1853). ♂.

*Megachile intricata*, Sm. Descr. New Spec. Hymen. p. 61. no. 1 (1879).

♂ ♀.

Smith marked the male of *M. intricata* as his type, and it agrees in every respect with his *Osmia fervida*. There are no females of the latter species, but a female of *M. intricata* is certainly *Megachile* sens. str.

#### *Megachile (Eumegachile) paucipunctulata*, W. F. Kirby.

*Megachile paucipunctulata*, Kirby, Bull. Liverpool Museum, vol. iii. p. 21 (1900). ♀.

*Megachile (Eumegachile) sokotrana*, Friese, Zeitschr. Hym. Dipt. Bd. iii. p. 287 (1903). ♀.

An examination of Kirby's type proves that Kohl was correct in placing the species in this subgenus.

#### *Megachile discolor*, Smith.

*Megachile discolor*, Smith, Catal. Hymen. Brit. Mus. i. p. 157 (1853).

♀.

*Megachile fülleborni*, Friese, Zeitschr. Hym. Dipt. Bd. iii. p. 281 (1903).

♂ ♀.

This species is widely spread in Africa. Smith redescribed it from the Gambia. There are other specimens from Zungeru, N. Nigeria, iv. 1910 (*J. W. Scott-Macfie*); near Johannesburg, Transvaal (*A. J. Chalmley*); Salisbury, Mashonaland (*G. A. K. Marshall*); various localities in N.E. Rhodesia (*S. A. Neave*); N. Rhodesia, Sinapunga, 13. ii. 1911 (*Silverlock Coll.*); and Nyasaland, Karonga (*S. A. Neave*).

*Megachile (Amegachile) fimbriata*, Smith.

Smith's type of this species from the Gambia agrees well in all points of structure with a male of *M. cærulea*, Friese, determined by Friese himself, from Nyasaland. *M. fimbriata* has the abdomen clothed with fulvous pubescence; possibly *M. cærulea* may prove to be a subspecies.

*Megachile (Amegachile) bituberculata*, Rits.

*Megachile bituberculata*, Rits. Tijdschr. v. Entom. xxiii. Versl. p. xevii (1880).

*Megachile tuberculata*, Smith, Descr. New Spec. Hymen. p. 63. no. 8 (1879). ♀. [Nec Smith, 1857.]

*Megachile (Amegachile) sjöstedti*, Friese, Zeitschr. Hym. Dipt. Bd. i. p. 72 (1901). ♀.

A specimen from Ilesha, S. Nigeria, 4. iii. 1910 (*J. J. Simpson*), determined by Dr. Friese, agrees with Smith's type of *M. tuberculata* in the British Museum.

*Megachile (Amegachile) nasalis*, Smith.

*Megachile nasalis*, Smith, Descr. New Spec. Hymen. p. 61. no. 2 (1879). ♀.

*Megachile (Amegachile) volkmanni*, Friese, Zeitschr. Hym. Dipt. Bd. iv. p. 299 (1904).

Smith's type from Zululand, in the British Museum, belongs to Friese's subgenus *Amegachile*.

Other specimens in the collection are from N.E. Rhodesia, Fort Jameson, 3800 feet, September 1910 (*S. A. Neave*), presented by the Entomological Research Committee (Tropical Africa); S.E. Congo Free State, Lufira River, Katanga, 3500 feet, 27. viii. 07 (*S. A. Neave*); and Lake Shirwa, Zomba, B.C.A. (*R. Newstead*).

*Megachile æthiops*, Smith.

*Megachile æthiops*, Smith, Catal. Hymen. Brit. Mus. i. p. 166. no. 68 (1853).

*Lithurgus æthiops*, Friese, Die Bienen Afrikas, p. 322 (1910).

This species is not a *Lithurgus*, as recorded by Friese in 'Die Bienen Afrikas,' p. 322. It resembles the European *M. muraria* superficially. The clypeus is somewhat of the *Chalicodoma* type and is crenulated apically.

*Megachile habropodoides*, sp. n.

♀. Nigra, hirsuta; capite, pleuris, abdominis segmentis 1-4 nigro-, segmentis 5 et 6 fulvo-ferrugineo-hirsutis; pronoto, mesonoto, scutelloque flavo-cinereo-hirsutis; scopa fulvo-ferruginea; clypeo subtruncato, apice duobus tuberculis minutis munito; mandibulis robustis, 4-dentatis; alis hyalinis.

Long. 15 mm.

♂. Similis sed clypeo flavo-cinereo-hirsuto, prosterno spatium postocularem griseo pubescentibus; mandibulis apice ferrugineis, elongatis; tarsis anterioribus albidis, dilatatis, albo-tomentosis; coxar. tuberculo subacuto instructa.

♀. Black; head, pleuræ, abdominal tergites 1-4, and legs for the most part covered with long black hair; pronotum, mesonotum, and scutellum clothed with a dense cinereous pile; abdominal tergites 5 and 6 covered with long ferruginous hairs; intermediate and posterior tarsi covered within by dark ferruginous hair. Scopa ferruginous red. Calcaria ferruginous. Wings hyaline. Clypeus subtruncate, broader than long, armed with two small tubercles at apex; mandibles massive, 4-toothed. The whole insect somewhat finely and evenly punctured. Metatarsus iii. normal, about as long as tibia.

Length 15 mm.

♂. Similar to the female, but with the face and clypeus covered with a long, dense, cinereous pile; postocellar region and prosternum clothed with thin white pubescence. Clypeus black at base, apically ferruginous, somewhat swollen. Anterior tarsi ivory-white, dilated, and fringed with long white hair, anterior coxæ provided with stout blunt tubercles. Abdominal segment 7 bidentate.

43 ♀ ♀, 5 ♂ ♂.

*Hab.* Khamba Jong, Sikkim, 15,000-16,000 feet, 15-30. vii. 1903. Collected by H. T. Walton on the Tibet Expedition (1903-4).

The colouring and general robust facies of this insect strongly recall *Bombus* and *Anthophora*.



*Megachile (Eumegachile) neavei*, sp. n.

♀. Nigra; facie nigro-, genis infra, thorace omnino, abdominis segmento primo omnino, segmento secundo lateribus albido-hirtis; segmentis 2 et 3 sparsim, 4-6 dense ferrugineo-tomentosis; scopa aureo-brunnea, basi pallidiore; clypeo basi tuberculo mediano lato instructo; mandibulis forcipatis; metatarsis angustis; alis fuscis.

Long. 16 mm.

♀. Black; the face densely and vertex sparsely covered with dark pubescence; the cheeks below, the whole thorax, first abdominal tergite wholly, and second abdominal tergite apico-laterally clothed with white pubescence; the rest of the abdomen covered with ferruginous-red pubescence, that on segments 2 and 3 much sparser; legs dark ferruginous, tarsi inclining to black, intermediate and posterior tarsi with rufous pubescence on the inner side. Scopa golden brown, paler at the base. Wings dark brown.

Clypeus very short, with a broad tubercle in the centre; mandibles arched, bidentate at apex. Punctured, mandibles and abdomen finely, clypeus, head, and thorax closely and somewhat coarsely. Metatarsus iii. slender, shorter than and about half as broad as tibia.

Length 16 mm.

♂. Similar to the female in general appearance, but with apex of clypeus and interantennal space covered with white pilosity, coxa i. with a short slender spine, abdominal segment 6 impressed at apex (as in *M. chrysorrhæa*).

2 ♀ ♀, 3 ♂ ♂.

*Hab.* Lower Luangwa River, N.E. Rhodesia, Sept. 1910 (*S. A. Neave*), type ♀; Ngoa, Nyasaland, 21. x. 1910 (*Dr. J. E. S. Old*), ♂ ♀; Fort Jameson, 3800 feet, Oct. 1910, and Luangwa to Petauke, Sept. 1910, N.E. Rhodesia (*S. A. Neave*), ♂ ♂.

This species comes nearest to *M. cornigera*, Fr., but differs in having the mandibles 3-toothed (in *cornigera* they are 5-6-toothed) and abdominal segment 1 and part of 2 white-, not black-haired.

*Megachile battorensis*, sp. n.

♀. *M. (Eumegachile) rufipedis* similis, sed non *Eumegachile*. Capite thoraceque antice fusco-, postscutello, segmento mediano, pleuris, abdominisque segmento primo basi pallide flavo-hirtis; segmentis abdominis 1 apice, 2 et 3 omnino ferrugineo-tomentosis, 4-6

sparsim nigro-hirtis; scopa ferruginea, apice obscuriore, nigra; pedibus brunneis, plus minusve flavo-pilosis; alis flavo-hyalinis, apice fuscis; tegulis ferrugineis. Clypeo truncato, plano, crasse punctato; mandibulis robustis, rugoso-striatis.

Long. 20 mm.

Similar to *M. rufipes*, F., differing as follows:—

*M. (Eumegachile) rufipes*, F.

Clypeus extremely short, with median tubercle; mandibles arched, slender. (Subgenus *Eumegachile*.)

Legs red.

*M. battorensis*, sp. n.

Clypeus normal, rather broader than long; no carina; mandibles stout, not arched. (Subgenus *Megachile*.)

Legs brown.

Length 20 mm.

*Hab.* Battor, Gold Coast, Oct. 1911 (*H. T. Palmer*), 1 ♀, type; Uganda Protectorate, between Seziwa R. and Kampala, 3500–3750 feet, Aug. 1911 (*S. A. Neave*), 3 ♀; Entebbe, Uganda, Aug. 1911 (*C. C. Gowdey*), 1 ♀. Presented by the Entomological Research Committee (Tropical Africa).

In *Megachile* sens. str. the most nearly allied species appear to be *M. stephanelli*, Friese, also from W. Africa, and *M. kigonserana*, Friese, from German East Africa.

*M. stephanelli* has the scopa fuscous at base and grey at apex, and the wings smoky, while in *M. kigonserana* the thorax is wholly black-haired and the wings are hyaline.

### *Megachile (Amegachile) frederici*, sp. n.

♀. Nigra, nitida; mandibulis (apice excepto), antennis basi, pedibus tegulisque rufis; facie argenteo-brunneo-, genis, pleuris sparsim, segmento mediano, abdominisque segmento primo lateribus albido-pilosis; scopa nigra, basi pallida; metatarsus iii. intus aureo-hirtis; clypeo apice emarginato; mandibulis robustis, apice 4-dentatis; alis plerumque cæruleo-micantibus, basi extremo hyalinis.

Long. 15 mm.

♀. Shining black; mandibles (except the apex), scape, flagellum beneath, tegulae, and legs red; the face about the insertion of the antennae clothed with silvery-brown pubescence, interspersed with a few black hairs; the pleurae sparsely, median segment and abdominal tergite 1 densely clothed on the sides with white pubescence; scopa black, sternite 1 medially clothed with pale hair.

Wings with a bluish effulgence, the extreme base hyaline.

Clypeus about as broad as long, emarginate at apex, the

sides of the emargination produced to form two tubercles; mandibles massive, 4-toothed. Whole insect somewhat sparsely and evenly punctured, metatarsus iii. broader than tibiæ.

Length 15 mm.

♂. Similar to female, but smaller. Face and clypeus clothed with pale hair. First joint of anterior tarsi dilated, anterior coxæ armed with spines.

2 ♀ ♀, 1 ♂.

Gambia (*F. Smith Coll.*), ♂ ♀ (type); Zungeru, N. Nigeria (*Dr. W. Morrison*), ♀.

Most nearly allied to *M. bituberculata*, Rits., = *sjöstedti*, Fr., but at once separated from that species by the red legs and black ventral scopa. The species bore a MS. label "*cyanipennis*, Guér.," in *F. Smith's Coll.*, and it certainly bears a superficial resemblance to that species.

*Key to the Australian Species of Megachile described  
by F. Smith.*

♀ ♀.

- |    |   |   |                               |
|----|---|---|-------------------------------|
| 1. | { | Clypeus very short, 3-4 times as broad as long, more or less armed with tubercles at apex. Scopa pale, black species with pale pubescence . . . . .                                       | 2. Subg. <i>Eumegachile</i> . |
|    |   | Clypeus normal, 1-2 times as broad as long; variously coloured insects . . . . .  | 5. Subg. <i>Megachile</i> .   |
| 2. | { | Clypeus truncate, the apex armed with a small tubercle or tubercles . . . . .   | 3.                            |
|    |   | Clypeus with a broad, medio-apical, subquadrate lobe, or else porrect, with the apex semicircular; wings fusco-hyaline . . . . .  | 4.                            |
| 3. | { | Apex of clypeus with small lateral tubercles; head very massive; wings fuscous; abd. tergite 1 with white pubescence; scopa pale testaceous. L. 21 mm. (Champion Bay.) . . . . .          | <i>monstrosa</i> .            |
|    |   | Clypeus with a small medio-apical tubercle; head normal; wings fusco-hyaline; abd. tergites 1 and 2 with white pubescence; scopa pale yellow. L. 18 mm. (Adelaide.) . . . . .             | <i>semiluctuosa</i> .         |
| 4. | { | Apex of clypeus with a broad, medio-apical, subquadrate lobe; face covered with dense golden pubescence; abd. tergite 6 with silver-grey pubescence. L. 13 mm. ("New Holland.") . . . . . | <i>aurifrons</i> .            |
|    |   | Clypeus porrect, the apex semicircular; face sparsely clothed with grey hairs; abd. tergite 6 with golden pubescence. L. 12 mm. (Champion Bay.) . . . . .                                 | <i>nasuta</i> .               |

- |     |   |                       |
|-----|---|-----------------------|
| 5.  | { Abdomen unicolorous; scopa bright fulvous .....   | 6.                    |
|     | { Median segment and abdomen basally with white pubescence. L. 14-15 mm.  | 7.                    |
|     | { Abdomen otherwise coloured; scopa pale; wings hyaline .....   | 9.                    |
| 6.  | { Abdomen covered with bright fulvous pubescence; wings fuscous. L. 16 mm. (Australia.) .....   | <i>ustulata.</i>      |
|     | { Abdomen black, with violet iridescence; wings fusco-hyaline. L. 14 mm. (Richmond River.) .....  | <i>pictiventris.</i>  |
| 7.  | { Wings dark fuscous; scopa black. (Champion Bay.) .....  | <i>fumipennis.</i>    |
|     | { Wings not dark fuscous; scopa white..   | 8.                    |
| 8.  | { Wings wholly dark fusco-hyaline, abd. tergite 3 black. ("New Holland.")..   | <i>lucidiventris.</i> |
|     | { Wings with basal half hyaline, fuscous apically; abd. tergite 3 laterally with white pubescence. (Champion Bay.)  | <i>fabricator</i>     |
| 9.  | { Abdominal tergites with apical fasciæ of pubescence .....   | 13.                   |
|     | { Abdominal tergites 1-3 with apico-lateral marks of pale pubescence; abd. tergites 5 and 6 with golden-yellow or fulvous pubescence .....                            | 10.                   |
|     | { Abdominal tergites 1 and 2 black, 3-6 ferruginous. L. 10 mm. (Queensland.)  | <i>calida.</i>        |
| 10. | { Face sparsely clothed with white pubescence; slender insects .....  | 21.                   |
|     | { Face clothed with golden pubescence; a robust insect. L. 13 mm. (Champion Bay.) .....   | <i>sexmaculata.</i>   |
| 11. | { Apex of clypeus simple. L. $11\frac{1}{2}$ mm. (Tasmania.) .....  | <i>leucopyga.</i>     |
|     | { Apex of clypeus with a small tubercle or tubercles .....  | 12.                   |
| 12. | { Apex of clypeus with 2 small tubercles; abd. tergite 4 with narrow whitish-yellow fasciæ. L. 11 mm. (Adelaide.)   | <i>eriadiformis.</i>  |
|     | { Apex of clypeus with a small median tubercle; no fascia on abd. tergite 4. L. 10 mm. (Western Australia.) ..  | <i>oblonga.</i>       |
| 13. | { Sides of face sparsely covered with white pubescence, abdominal fasciæ narrow; smaller, more slender insects. ....  | 16.                   |
|     | { Whole face (including clypeus) covered with dense ochraceous or fulvous pubescence, abdominal fasciæ broader; more robust insects .....                             | 14.                   |
| 14. | { Face densely covered with fulvous pubescence; abd. tergite 5 partly and 6 wholly covered with fulvous pubescence. L. $12\frac{1}{2}$ mm. (Western Australia.) ..... | <i>chrysopyga</i>     |
|     | { Face densely covered with ochraceous pubescence; abdomen unicolorous, with ochraceous fasciæ. L. 13 mm. ....  | 15.                   |



15. { Disc of mesonotum with spots of ochraceous pubescence. (W. Australia)... *macularis*, D. T.  
(*maculata*, Sm.)  
Disc of mesonotum not so spotted. (Champion Bay.)..... *australusiæ*, D. T.  
(*imitata*, Sm.)
16. { All the abd. tergites black, with narrow apical fasciæ. L. 10 mm. (Hunter River.) ..... *simplex*.  
Abd. tergite 6 or 5 and 6 otherwise coloured ..... 17.
17. { Abd. tergite 6 laterally ferruginous; a small insect. L. 8 mm. (Adelaide.) *apicata*.  
Larger insects. L. 11 mm. .... 18.
18. { Abd. tergite 6 with a short griseous pilosity. (Tasmania.) ..... *ordinaria*.  
Abd. tergites 5 (apically) and 6 with pale fulvous pilosity. (Australia.) ..... *modesta*.

♂ ♂.

1. { Anterior tarsi dilated, anterior coxæ armed with spines ..... 2.  
Anterior tarsi simple, anterior coxæ unarmed ..... 3.
2. { Face covered with fulvous pubescence; abd. tergite 6 black. L. 13 mm. ("New Holland.") ..... *latipes*.  
Face covered with white pubescence; abd. tergite 5 with a patch of ferruginous pubescence. L. 11 mm. (Swan River.) ..... *ferox*.
3. { Abd. tergite 6 entire, not emarginate; face with white pubescence ..... 4.  
Abd. tergite 6 notched; face with yellow or fulvous pubescence; abdomen black, with white or white and ferruginous pubescence ..... 5.
4. { Abd. tergite 6 bluntly rounded; abdomen black, with white pubescence basally; tergite 5 with a patch of ferruginous pubescence. L. 9 mm. (W. Australia.) ..... *canifrons*.  
Abd. tergite 6 truncate; abdomen wholly ferruginous. L. 8 mm. (Macintyre River.) ..... *abdominalis*.
5. { Abdomen black, with white pubescence basally; tergites 4 (apically) and 5 or 5 and 6 ferruginous; abdomen not coarsely punctured ..... 6.  
Abdomen black, with white pubescence basally; apical tergites black; abdomen coarsely punctured ..... 7.
6. { Tergite 6 deeply notched, tergites 5 and 6 ferruginous. L. 14 mm. ("New Holland.") ..... *ignita*.  
Tergite 6 faintly notched; an apical fascia on tergite 4 and tergite 5 for the most part ferruginous. L. 11 mm. (W. Australia.) ..... *erythropyga*.

7. { Tergite 1 with small apico-lateral tufts  
of white pubescence. L. 13 mm.  
("New Holland.") ..... *punctata*.  
Tergite 1 wholly and 2 apico-laterally  
clothed with white pubescence. L.  
11 mm. (W. Australia.) ..... *rugosa*.

*Megachile exaltata*, Smith.

*Megachile exaltata*, Smith, Catal. Hymen. Brit. Mus. i. p. 185 (1853).

♂.

*Megachile incongrua*, Smith, Descr. New Spec. Hymen. p. 78 (1879).

♂ ♀.

The older species, described from the male alone (Rio Tapajos, Brazil), is certainly co-specific with *M. incongrua* from Tunantins, of which both sexes are described.

ANTHIDIUM, F.

*Anthidium (Proanthidium) cimbiciforme*, Smith.

This is a valid species, and not synonymous with *A. laterale*, Latr., as stated by Friese, 'Bienen Europas,' iv. p. 153 (1898).

The yellow markings are much more profuse than in *laterale*. The antennæ and two curved lines on the disc of the mesonotum are yellow. In the males the apical segments of the two species show great disparity; in *A. laterale* the seventh abdominal tergite bears a short median tubercle, whereas in *A. cimbiciforme* the median prolongation is long and apically truncate.

The species was described from Albania.

*Anthidium africanum*, Smith.

? *Euaspis abdominale*, F. ♂.

There seems to be a great probability that Smith's species is the male of *E. abdominale*, F. Friese ('Die Bienen Afrikas') quotes *Stelis rufiventris*, Lep., as the male of that species, querying the locality (Brazil) given by Lepeletier (Hist. nat. Insect. Hymén. ii. p. 531), though Lepeletier himself seemed in no doubt about it.

Smith's type is 14 mm. in length, though he inexplicably gives 5 lines.

In the British Museum copy of Smith's Catalogue *A. africanum* is followed by a MS. note "♂ of no. 69," i. e. *A. bicolor*, this being the synonymy adopted by Friese in 'Die Bienen Afrikas.' In 'Das Tierreich' he has placed the two species separate. An earlier MS. alteration by Smith is a bracket uniting *A. africanum* and *A.* (now *Euaspis*) *abdominale*, F.; and this appears to be the correct solution.

LIX.—*Observations on living Gorgonias* (*Gorgonia verrucosa*) occurring in the English Channel. By J. STUART THOMSON, Ph.D., F.L.S., F.R.S.E., Lecturer and Senior Demonstrator in Zoology, Victoria University of Manchester.

DURING a brief period of work at the Marine Biological Station, Roscoff, in August 1912, I had excellent opportunities of observing the variations in the form of *Gorgonia verrucosa*, Pall., from living specimens, and of comparing the latter with the form designated *Gorgonia cavolini*, von Koch.

These two forms, sometimes called Sea-fans, are the commonest Gorgonaceæ occurring in the Gulf of Naples, the Gulf of Lyons, and in the English Channel, off the coasts of Brittany, Devonshire, and Cornwall.

In 1887, von Koch in his admirable Monograph on the Gorgonidæ of the Gulf of Naples, gives a detailed account of the anatomy and development of a red *Gorgonia* under the name *Gorgonia cavolini*, sp. n., which he regards as very similar to, but not identical with, *Gorgonia verrucosa*, Pall. Von Koch holds that naturalists had, hitherto, frequently erred in regarding these two forms as belonging to the same species. He rightly insists that one should observe as many forms as possible before arriving at conclusions as to their identification.

The object of this note is mainly to state my reasons for regarding *Gorgonia verrucosa*, Pall., and *Gorgonia cavolini*, von Koch, as one and the same species. It is of importance in the determination of species that specimens from different localities should be compared with one another; and my present note is of importance in this connection, as von Koch's work was based on Mediterranean forms, but my observations are on specimens from the western part of the English Channel, namely from the coasts of Brittany. It is also almost necessary in some difficult or disputable cases that Alcyonarian forms should be studied in the living state.

The first character upon which von Koch rests his determination is the colour—*Gorgonia cavolini* being red, *Gorgonia verrucosa* white. When these two forms are dead or preserved in spirit, they are both white and are practically indistinguishable. The colour of the red form, *Gorgonia cavolini*, is very unstable, disappearing very readily and rapidly, and the pigment is not present in the spicules. The red colour of *Gorgonia cavolini* also varies in shade in different specimens even in the living state; thus I find some

much paler in colour, and on the other hand there are examples of *Gorgonia verrucosa* which have yellowish or slightly reddish tints. Von Koch also mentions the occurrence of a yellowish-red specimen of *Gorgonia cavolini*.

This instability of the colouring is met with in other Alcyonarian forms, and perhaps it is most conspicuously illustrated in *Alcyonium purpureum*, Hickson, occurring in False Bay at the Cape of Good Hope. *Alcyonium purpureum* is a brilliant purple colour (not due to the spicules), which it has been found almost impossible to retain by different methods of preservation.

The colour of Alcyonarians has within recent years been recognized as being so variable in character that it is no longer regarded as of importance in the determination of species.

After an examination of a number of the red form (*Gorgonia cavolini*) and of the white form (*Gorgonia verrucosa*) it appears to me that none of the characters which von Koch gives for their differentiation into two species will hold in all cases. The characters by which von Koch separates *Gorgonia cavolini* from *Gorgonia verrucosa* are as follows:—

*Gorgonia verrucosa*, Pall.

The colonies are white during life,

The colonies are, as a rule, of larger size.

The branching is rarely in one plane and is irregular.

The branches are longer and less divided up into minor branches. The branches frequently appear little thinner than the stem, and often have a tendency to lie parallel to one another, and perpendicular to the basal plane of attachment.

The polyps are yellowish or light brown.

The polyps are not arranged in rows on the twigs.

The polyps have the margins of the calyces divided up into 5-8 lobes, but *usually* into 8.

Yellow cells occur in the ectoderm of the tentacles.

*Gorgonia cavolini*, v. Koch.

Are red or reddish during life, white when dried or preserved in alcohol.

The branching is in one plane and more regular.

The branches are shorter and fairly uniform; the twigs are little thinner than the branches and always disposed in one plane.

The polyps are reddish,

The polyps are arranged in rows on the twigs.

The margins of the calyces are *usually* 5-lobed.

Yellow cells do not occur in the ectoderm of the tentacles.



I would now indicate that the points stated above, by which von Koch seeks to distinguish *Gorgonia verrucosa* from *Gorgonia cavolini*, are not sufficiently constant in either variety to enable one to hold this position.

I have already alluded to the colour, and pointed out that the red coloration of *Gorgonia cavolini* is unstable. In regard to size, the relative size of the red and white form is so variable that it appears to me that no definite character can be deduced from this point.

Specific characters are derived by some authors from the mode of branching, but von Koch's most important contrast in this respect—namely, the branching in *Gorgonia cavolini* in one plane but not so in *Gorgonia verrucosa*—does not hold strictly true for many specimens of either form which I have examined. Further, I find the disposition of the branches, their relative thickness to the stem, so variable in both the white and the red variety that I cannot attach specific importance to these points.

Regarding the mode of occurrence of the polyps on the twigs, I have been unable to find in a number of the red forms, *Gorgonia cavolini*, a regular arrangement in rows.

In the older colonies of *Gorgonia verrucosa* one frequently finds that the majority of the polyps have a 5-lobed calyx, and, on the other hand, one occasionally observes an 8-lobed calyx in *Gorgonia cavolini*. Von Koch notes and figures in another part of his monograph that there is variability in regard to this point. I believe that the presence of eight lobes in the calyx is only a temporary stage.

It seems true that yellow cells are, as a rule, present in the tentacles of the polyps of *Gorgonia verrucosa*; but, on the other hand, I am unable to confirm Koch's statement that these yellow cells do not occur in the tentacles of *Gorgonia cavolini*.

In his tables for the identification of the Gorgonaceæ of the Gulf of Naples, von Koch gives as a common character of *Gorgonia verrucosa* and *Gorgonia cavolini* that the polyps are without spicules. In another part of his monograph he writes of the presence of a number of needle-like spicules in the young developing polyps, and of these being later reduced in number in slightly older polyps to seven or eight for each tentacle, but that these spicules are absent in the polyps of the trunk. In both forms I find seven needle-like spicules at the base of each tentacle in the polyps of the trunk.

My reasons for regarding *Gorgonia verrucosa* and *Gorgonia cavolini* as the same species are as follows:—

The "habitus" of the two forms is, on the whole, the same. The form, size, and distribution of the spicules is similar.

The internal structure and development of the two forms is alike. The two forms are sexually mature at the same time. The two forms show variations, but during the young stages they are essentially in agreement.

One may slightly extend von Koch's characters for *Gorgonia verrucosa* so as to include *Gorgonia cavolini* as follows:—The ground-colour is white or red, the polyps yellow; brown, or reddish. The axis is dark, almost black, and scarcely visible through the rind. The surface of the rind appears smooth when magnified ten times. The branching may be irregular, but is frequently in one plane. The branches frequently tend to lie parallel to one another and perpendicular to the basal plane of attachment. The relative size of the stem and branches is variable, frequently no great difference between them.

The spicules of the rind and verrucæ are clubs and spindles arranged in two layers; the clubs of the external layer stand very close to one another and with their principal axes perpendicular to the surface. The spicules are transparent.

The polyps are retractile, and there are usually seven or eight small, needle-like spicules at the base of each tentacle. The polyps are scattered over the surface of the cœnenchyma, but sometimes show a tendency on the smallest branches towards an arrangement in rows.

The verrucæ have the form of low warts, with 5-8, usually 5, marginal lobes.

Yellow or red cells occur in the ectoderm of the tentacles.

I would therefore suggest that one should retain the older specific name *verrucosa* and abandon that of *cavolini*, but that the species *verrucosa* be recognized as including two varieties—red and white. It is also to be noted that these two forms, *verrucosa* and *cavolini*, are now frequently referred to the genus *Eunicella*.

In 1869 Verrill constituted the new genus *Eunicella*, taking *Gorgonia verrucosa*, Pall., as his generic type, and regarded it as belonging to the family Plexauridæ. Verrill's diagnosis of the genus *Eunicella* is as follows:—

“Cœnenchyma thin or moderately thick, composed chiefly of small warty double spindles, but having a distinct external layer of very small, peculiar club-shaped spicules perpendicular to the surface, which often have one or two whorls of fine spindles towards the larger end. Cells scattered, either raised on prominent verrucæ or perfectly flat. Longitudinal ducts nearly equal, in a circle around the axis. The colour usually white.”

In some measure this brief note is a protest against the splitting up of Alcyonarian genera into an unnecessary number of species, and undoubtedly there are other specific names under the genus *Gorgonia* which do not represent true species.

I may now shortly refer to one or two other points observed during the course of this comparison. It is interesting to find that when a twig of *Gorgonia* (*Eunicella*) *verrucosa* is isolated from the rest of the colony, and left in a well-aerated aquarium, it has the power of living on for some time (for at least a fortnight) apparently in an active condition, showing the extension and retraction of the tentacles. From our knowledge of the powers of regeneration possessed by other members of the Coelenterate Phylum, it is possible that *Gorgonia* has the power of propagation from twigs which have been broken away from the main colony.

Another point which I may mention is that the red and white specimens were sexually mature at Roscoff on the 20th of August; this is much later than those of the Mediterranean, which are recorded as being mature in May and June.

The distribution of *Eunicella* (*Gorgonia*) *verrucosa* is a wide one in European waters. It has been accurately recorded at the following:—

Off the coasts of Devonshire and Cornwall—Mewstone Ledge, very common; Queen's Ground; Rame; Eddystone Ground; Stoke Point Ground. Usually at a depth of 10–20 fathoms.

Off the coasts of Brittany, common. Off the west coast of Scotland, rare. Off Marseilles and Nice, the Bay of Naples, the Adriatic and other localities on the Italian coast.

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LX.—*Descriptions and Records of Bees.*—XLVII.

By T. D. A. COCKERELL, University of Colorado.

*Ceratina læta*, Spinola.Trinidad, March 1912 (*Hugh Scott*). New to Trinidad.*Ceratina minima*, Friese.Trinidad, March 22, 1912 (*Hugh Scott*). Three males, marked "Diego Martin; herbage by stream."*Nomada (Micronomada) jamaicensis*, sp. n.

♀. Length a little over 6 mm.

Ferruginous, including the legs, but the abdomen mainly black above; head broad; basal part of mandibles broadly pale yellow; sides of face broadly light yellow, this colour ending obtusely a little above level of middle of front, and below ending about level of middle of clypeus; labrum blackish in middle; clypeus, supraclypeal area, front and cheeks bright ferruginous, the cheeks with a broad yellow stripe along upper part of orbits; interocellar region blackened; antennæ entirely ferruginous, third joint longer than fourth; thorax above densely and coarsely punctured, the ridges between the punctures shining; upper border of prothorax, tubercles, scutellum, band on postscutellum, two large patches on metathorax, and very large transverse patches on pleura, bright yellow; mesothorax suffused with black in middle posteriorly, and area of metathorax also blackish; the extremely scanty pubescence of thorax light fulvous above, white at sides; tegulæ creamy white, punctured. Wings long, with a conspicuous dusky apical cloud; stigma ferruginous, nervures fuscous; b. n. meeting t.-m.; second s.m. receiving first r. n. before middle. Legs bright red, hind coxæ with a large yellow mark, hind tibiæ slightly yellowish at base; spines of anterior coxæ short, but very distinct. Abdomen very finely punctured: first segment with a broad yellow band, narrowest in middle, the part before the band dark red; second segment with a yellow band which is extremely broad at sides, but greatly narrowed, or even broken, in middle; third and fourth segments with a large yellow mark on each side, fifth with a band (these markings often largely concealed by the retraction of the segments); apical segment with a semicircular pale pubescent area; venter dark ferruginous, with a broad yellow band on third segment,



♂. Similar to the female, except as follows: ground-colour of head and thorax black, not red; labrum pale reddish; clypeus and supraclypeal area bright yellow, and the bright yellow lateral face-marks wholly filling space between clypeus and eye; yellow band along posterior orbits variable, either extending along whole length of orbit or broken in middle; basal part of first abdominal segment black; apical plate of abdomen broad, truncate, not emarginate.

*Hab.* Liguanea Plain, Jamaica, Nov.-Dec. 1911, three of each sex (*C. T. Brues*). One was collected by Mrs. Brues. The type is a female.

The genus is new to Jamaica, and the species is closely related to the various *Micronomadae* inhabiting the western United States. From the species of Cuba, Haiti, and Porto Rico it is readily known by the red head and thorax of the female. By the red legs, it resembles *N. krugii*, Cress., from Porto Rico rather than *N. cubensis*, Cress., from Cuba.

*Halictus (Chloralictus) bruesi*, sp. n.

♂.—Length about or nearly 5 mm.

Entirely pale brownish testaceous, including antennæ and legs; clypeus prominent; face with fine white hair; eyes moderately emarginate within; antennæ long, the flagellum thick. Wings clear, iridescent, the stigma and nervures sepia; head and thorax dullish, abdomen shining; thorax with thin white hair.

The following characters are microscopic: front finely and very densely and evenly punctured; mesothorax microscopically tessellate, with rather widely separated very distinct punctures; area of metathorax with about twenty fine but distinct more or less wavy ridges; punctures of abdomen very fine, becoming moderately dense toward bases of segments, absent on apices of segments, which are transversely striatulate; first r. n. joining second s.m. a little before the beginning of its last fourth; outer nervures scarcely at all weakened.

*Hab.* Liguanea Plain, Jamaica, Nov.-Dec. 1911, 1 ♂ (*C. T. Brues*).

Easily known by its singular coloration, which made me think at first that it might be immature or diseased; but it is perfectly formed in every way, and doubtless normal. Many species of *Halictus* are more or less testaceous, or have the abdomen orange or brownish. The present insect is perhaps nearest to the Brazil an *H. nanus* (Smith), which, however, has the head and thorax yellowish green.

*Halictus leichardti*, Cockerell.

The type of *H. leichardti* is abraded; *H. paracolletinus*, Ckll., described from fresh specimens, is the same species. I arrived at this conclusion after the types had been returned to the British Museum, but Messrs. Meade-Waldo and Turner have kindly compared the types, and have no doubt that the names refer to a single species.

*Megachile liguanensis*, sp. n.

♀.—Length about 9 mm.

Black, with white pubescence (a slight admixture of dark hairs on vertex and scutellum); legs bright ferruginous, hair on inner side of tarsi orange-ferruginous, very bright on hind basitarsi; ventral scopa white, entirely black on last two segments; clypeus densely punctured, with a smooth shining median stripe, the lower margin feebly denticulate; mandibles quadridentate; flagellum beneath dark rufo-fuscous; vertex dull, densely and minutely punctured; mesothorax and scutellum sculptured like vertex; no anterior hair-spots on mesothorax, but a very conspicuous tuft of white hair on each side above the hind end of tegula; a rather feeble hair-band in scutello-mesothoracic suture, but long white hair behind scutellum. Wings slightly dusky, especially in costal region; stigma dull ferruginous, nervures fuscous. Abdomen shovel-shaped, but not of the very broad type, shining, with narrow and weak white hair-bands; tegulae piceous, obscurely reddish toward the margins.

*Hab.* Liguanea Plain, Jamaica, Nov.—Dec. 1911 (*Mrs. C. T. Brues*).

From the same locality Mr. Brues sent also *M. lanata* (Fabr.), and *M. poeyi*, Guér. In Friese's table of West Indian *Megachile*, this runs to *M. deceptrix*, Smith, a larger and otherwise different insect, the type of which I have examined. It may also be compared with *M. poeyi*, which is larger and has yellow abdominal bands. I have not been able to find any species from North or South America which it closely resembles.

*Megachile huascari*, sp. n.

♀.—Length about or almost 13 mm.

Robust, broad, black, with black hair, mixed with dull white on face around antennae; ventral scopa light orange, last segment with scanty black hairs; clypeus shining but closely punctured, with no median smooth line, its anterior

margin with a very broadly triangular smooth impunctate space, the actual margin, which is straight, deeply transversely channelled; antennæ entirely black; vertex finely and quite closely punctured; mesothorax closely punctured at sides, but the middle very broadly smooth and shining, with widely scattered punctures; tegulæ with reddish margins. Wings fuliginous; spurs ferruginous.

*Hab.* Huascaray, Peru, 6500 ft., Sept. 21 (*C. H. T. Townsend*).

Very close to *M. piurensis*, Ckll., which is known only in the male. I was at first disposed to regard it as the female of that species, but as the sculpture of the mesothorax is entirely different, and the insect comes from a different locality, it must be presumed to be distinct. Superficially, seen from above, *M. huascari* might be taken for a rather small example of *M. xylocopoides*, Sm. The locality is evidently named after Huascar, to whom I have accordingly dedicated the bee.

*Megachile microsoma*, Cockerell.

Manaos, Brazil (*B. Piffard*). British Museum.

*Megachile agustini*, Cockerell.

Abbott Ranch, Rito de los Frijoles, New Mexico, Aug. 1912 (*Cockerell*).

*Megachile sayi sancta*, subsp. n.

♂.—Like *M. sayi heterodonta*, but hair of face strongly suffused with tawny; wings not reddened (the stigma is clear ferruginous), but with a strong dusky apical cloud; middle of mesothorax covered with black hair; eyes purplish black instead of green; fifth dorsal abdominal segment, before the band, with the hair entirely black, long and coarse. Legs as in *heterodonta*.

*Hab.* Santa Fé, New Mexico, August 3, 1912 (*Cockerell*).

*Megachile pugnata*, Say.

♂.—Santa Fé, New Mexico, August 1, 1912, at flowers of *Hymenoxys floribunda*. (*Cockerell*.)

*Epeolus novomexicanus*, sp. n.

♂.—Length 6 mm.

Black, with the tubercles, ends of axillar teeth, and venter of abdomen ferruginous; antennæ clear ferruginous, the scape blackened above; legs clear bright ferruginous, the

spurs of the same colour; tegulæ light apricot-colour; apical plate of abdomen red, rounded, entire; eyes pale green; face, except lower part, covered with brilliant silver-white appressed hair; clypeus minutely granular-punctate; labrum dark, obscurely reddish; mandibles red; hair of cheeks and vertex, and thorax above, slightly tinged with ochreous; mesothorax finely rugose, its hair dense around the margins and in anterior middle, but not forming clean-cut markings; pleura densely covered with hair; axillar teeth broadly triangular, rather sharp. Wings dusky along apical margin. Abdomen with broad entire yellowish-white apical hair-bands, the other parts more thinly hairy; first segment densely hairy, except for a straight median band, the margins of which are very indistinctly defined; beneath the hair the bases of the segments become more or less reddish, while the apical margins become ivory-white.

*Hab.* Santa Fé, New Mexico, Aug. 2, 1912 (*Cockerell*).

A pretty little species, best known by the red antennæ and ill-defined band on first abdominal segment. These characters will at once separate it from *E. beulahensis*, Ckll., which is similar in general appearance. There is no distinct spot of pubescence on the anterior part of the mesothorax, such as is found in *E. crucis*, Ckll.

*Melissodes mizeæ*, Cockerell.

♀.—Abbott Ranch, Rito de los Frijoles, New Mexico, Aug. 1912 (*Cockerell*). The specimen differs from the type in having much more black hair on the legs.

*Andrena mellea*, Cresson.

♀.—Abbott Ranch, Rito de los Frijoles, New Mexico, Aug. 1912 (*Cockerell*).

*Prosopis aposuara*, Cockerell.

♂.—Stradbroke Island, Oct. 2, 1911 (*H. Hacker*); Queensland Museum, 50. Gilgai, N.S.W., Dec. 1911 (*Froggatt*, 212).

*Meroglossa persulcata*, Cockerell.

♂.—Brisbane, April 26, 1911 (Queensland Museum, 67).

*Palæorhiza perviridis* (*Cockerell*).

♀.—Kuranda (*F. P. Dodd*); Queensland Museum, 68.



*Gnathoprosopis hackeri*, sp. n.

♂.—Length a little over 7 mm.

Robust, black; mandibles broad and short, black; head rather broad; face below antennæ entirely smooth and shining pale yellow, with very sparse punctures; supra-clypeal area broad, pale yellow; lateral marks ending in a point near orbital margin at about level of middle of front; scape scarcely swollen, pale yellow in front; flagellum short and thick, ferruginous beneath; swollen upper border of prothorax and tubercles bright chrome-yellow; rest of thorax entirely dark; mesothorax closely and finely punctured; area of metathorax coarsely and very irregularly cancellate, posteriorly with a transverse keel. Legs brownish black, the anterior tibiæ in front, a stripe on middle tibiæ, and base of hind tibiæ yellow; tarsi reddened apically; tegulæ piceous. Wings hyaline, stigma and nervures dark; first r. n. entering apical end of first s.m., which is very long. Abdomen broad, shining, but finely and closely punctured, with conspicuous erect hair, which is greyish white except apically, where it is dark fuscous; ventral teeth extremely large, conical, with no ridge between them.

*Hab.* Sunnybank, Brisbane, Queensland, Jan. 17, 1912 (*H. Hacker*). Queensland Museum, 36.

Nearest to *G. bituberculata* (Smith), but easily separated by the light yellow face and the relatively slender scape. The type of this genus will be known as *Gnathoprosopis euxantha* (Ckll.), the name *xanthopoda* being preoccupied.

*Prosopis kelvini*, sp. n.

♀.—Length nearly 8 mm.

Black; rather robust; head rather elongate; face-markings reduced to an elongate-oval yellow spot on each side, its upper end level with antennæ; cheeks small; face finely longitudinally striate, the high and narrow clypeus with a fine median longitudinal keel; mesothorax and scutellum very finely but distinctly punctured; the swollen upper border of prothorax and tubercles bright chrome-yellow; no other yellow on thorax; postscutellum with fine short light pubescence, especially anteriorly; area of metathorax with the basal part very irregularly cancellate, no transverse keel. Legs black; anterior tibiæ with an obscure reddish spot in front near base; anterior and middle femora short and broad; tegulæ piceous. Wings clear, stigma and

nervures dark ; second s.m. long, receiving both recurrent nervures. Abdomen very finely punctured, scarcely at all hairy.

*Hab.* Kelvin Grove, Brisbane, Queensland, Nov. 20, 1911 (*H. Hacker*). Queensland Museum, 33.

Runs in my table of *Prosopis* to the vicinity of *P. amacula*, from which it is easily known by the reduced face-markings. It resembles in its markings *P. flavojugata*, Ckll., but that species has a much shorter head, the yellow spots on the face lower down, and the quadrate second submarginal cell entirely different from that of *kelvini*. In *P. amacula* also this cell is very much shorter than in *kelvini*. The second s.m. of *kelvini* is formed much as in *P. alcyonea* (Erichs.), which is in other respects a totally different insect.

*Prosopis leai*, sp. n.

♂.—Length about  $6\frac{1}{2}$  mm.

Rather slender ; the abdomen subclavate, narrowed basally ; black, with yellow markings ; head moderately elongate, face below antennæ yellow (reddened by cyanide in type), the very broad supraclypeal mark obtusely rounded or subtruncate above, the lateral marks ending abruptly at level of antennæ, the lower margin of clypeus dark ; scape with a yellowish mark in front ; flagellum long, ferruginous beneath ; the large tubercles, scutellum, and postscutellum, with a small elongate mark touching each anterior corner of scutellum, very bright chrome-yellow ; no other yellow on thorax ; mesothorax dull, the dense punctures so minute as to give the effect of a minutely granular surface ; area of metathorax shining, without distinct sculpture. Legs black ; anterior tibiæ ferruginous in front ; tegulæ piceous. Wings dusky at apex ; nervures and stigma dark ; first r. n. joining first t.-c. ; second s.m. longer below than high, but not much elongated. Abdomen dull, scarcely hairy ; venter normal.

*Hab.* National Park, New South Wales (*Lea*, 10716). Froggatt Coll. 143.

Best compared with *P. chrysognatha*, Ckll., and *P. aposuara*, Ckll., from both of which it differs by the much finer sculpture of the mesothorax. The broad supraclypeal area also separates it at once from *P. aposuara*. The second submarginal cell is shorter than in *chrysognatha*.

*Nomia lyonsiæ*, sp. n.

♀.—Length nearly 11 mm.

Black ; the first four abdominal segments with moderately broad emerald-green bands suffused with vermilion ; scutellum depressed in middle, but not bituberculate ; postscutellum with a pair of large lamellæ or teeth ; clypeus with a fine keel. Wings dusky hyaline.

So exactly like the Indian *N. ellioti*, Smith, that it is difficult to point out many differences. The postscutellar teeth are larger than in *ellioti*, and the punctures of the mesothorax are smaller and evidently of two sizes. The abdomen is more strongly and closely punctured, especially on the second segment. The antennæ are dark, with the flagellum faintly reddish beneath toward the apex.

*Hab.* Brisbane, Queensland, at flowers of *Lyonsia* (Apocynaceæ), Feb. 6, 1912 (*H. Hacker*). Queensland Museum, 60.

It seems not altogether impossible that this is the female of *N. darwinorum*, Ckll., described from Port Darwin. The localities, however, are about 1800 miles apart, and probably the species are distinct. *N. lyonsiæ* agrees structurally with *N. rubroviridis*, Ckll., but differs by the black hair covering apex of abdomen, partly black hair on thorax above, rather large punctures of mesothorax, and only moderately broad abdominal bands.

*Gastropsis pubescens* (Smith).

Brisbane, Queensland, Nov. 27, 1911 (*H. Hacker*). Queensland Museum, 54.

*Dioxys aurifuscus* (Titus).

*Dioxys fulvohirta*, Ducke, from Durango, Colorado, is apparently a synonym. Titus described his species in a distinct genus (*Chrysopheon*), and it was overlooked by Ducke.

*Xylocopa varians*, var. *piurensis*, v. nov.

♀.—Like var. *incarum*, Ckll., but hair on outer side of middle and hind basitarsi and end of hind tibiæ shining cream-colour ; herein it resembles var. *ecuadorica*, Ckll., but it differs from that in having the hair on inner side of tarsi (especially hind tarsi) bright ferruginous.

*Hab.* Piura, Peru (*C. H. T. Townsend*).

The varieties or races of *X. varians* may be separated thus :—

Tegulae red; hair on inner side of hind tarsi black.	
(S. Brazil.)	<i>variens</i> , Sm.
Tegulae black	
1. Hair on hind tarsi all red. (Peru.)	1. <i>incarum</i> , Ckll.
Hair on outer side of hind tarsi cream-colour	2.
2. Hair on inner side of hind tarsi black. (Ecuador.)	<i>ecuadorica</i> , Ckll.
Hair on inner side of hind tarsi red. (Peru.)	<i>piurensis</i> , Ckll.

*Xylocopa splendidula charapensis*, subsp. n.

♀.—Agrees with *X. splendidula*, Lep. (Mendoza specimen compared), except that the abdomen is more closely punctured and the hair on outer side of hind basitarsi (except at apex) is brilliant orange-ferruginous, while the middle basitarsi have a band of hair of the same colour.

*Hab.* Rio Charape, Peru, 5000 feet, Sept. 12–16 (*C. H. T. Townsend*).

*Xylocopa brasilianorum* (L.).

♂.—Cosma, Peru, April 6, 1912 (*C. H. T. Townsend*).

The yellow clypeus has a large diamond-shaped black mark, produced above to the margin, which is narrowly black-edged.

*Trigona nigerrima*, Cresson.

Rio Charape, Peru, 5000 feet, Sept. 12–16 (*C. H. T. Townsend*).

I cannot separate this from Guatemalan specimens. The species is new to Peru.

*Bombus vogti*, Friese.

A worker from Huascaray, Peru, 6500 feet, Sept. 21, 1911 (*C. H. T. Townsend*), agrees with Friese's brief description.

*Bombus butteli*, Friese.

Huascaray, Peru, 6500 feet, Sept. 21, 1911, workers and males (*C. H. T. Townsend*).

A peculiar species, apparently nearest to *B. funebris*, Smith, which also occurs in Peru.



*Nomia mesillensis*, Cockerell.

At Santa Fé, New Mexico, in the first week of August, 1912, I took a good series of *Nomia* at flowers of *Peritoma serrulatum*. To my surprise I find that the females are all *N. mesillensis*, while the males are those ascribed by me (Ann. & Mag. Nat. Hist., Oct. 1908, p. 333) to *N. foxii*. Fox described his *punctata* (*foxii*, D. T.) from the female, and the "distinctly punctured" abdomen clearly indicates the female I have called *foxii* rather than *mesillensis*. This female (from Las Cruces and Rincon, New Mexico) is, however, evidently the recently published *N. moctezumæ*, Crawford, which must, I think, be a synonym of *N. foxii*. The matter will be settled by the examination of the type of *foxii*, from Vega, S. José, N. M.

*Nomia nevadensis*, Cresson.

Santa Fé, New Mexico, Aug. 3, 1912 (*Cockerell*).

*Nomia savignyi*, Kohl.

Multan, India, Sept. 1909 (*E. Comber*). British Museum.

*Nomia comperta*, sp. n.

♂.—Length  $10\frac{1}{2}$  mm.

Black, with approximately the basal half of abdomen red; head broad; mandibles with a small rufous spot beyond middle; face densely covered with shining creamy-tinted hair; vertex shining, with very large, scattered, irregularly placed punctures; antennæ long, flagellum crenulate, dull red beneath; thorax brilliantly shining, the mesothorax and scutellum with scattered strong punctures; area of metathorax shining, with a minutely granular surface, but no ridges, its lateral extensions with a rather strong sulcus running down the middle; hair of thorax thin and long, white, very faintly creamy-tinted dorsally. Legs shining brown-black, with pale hair; hind coxæ with a small apical tubercle posteriorly; hind femora slightly swollen; hind tibiæ and tarsi normal; spurs very pale reddish; tegulæ brown, with the margin hyaline, not enlarged. Wings hyaline basally, dilute reddish-fuliginous apically; stigma pale orange-testaceous, nervures testaceous; second s.m. approximately square, receiving first r.n. a little beyond middle. Abdomen dullish sericeous, the hind margins of the segments shining; first segment with the basal half blackish, with an interrupted red band, the apical part clear

red (orange-ferruginous); second segment entirely clear red; third red, with a large, suffused, dusky, dorsal shade; remaining segments black; third and following segments with apical bands of white tomentum, such bands also at sides of second; hair at apex of abdomen white; fourth ventral with a prominent median apical lobe.

*Hab.* Nasik, India (*E. Comber*). British Museum.

Runs in Bingham's table to *N. pilipes*, Smith, but the colour of the pubescence and wings is so different that it cannot be the male of that species. There is a striking superficial resemblance to *N. phenacura*, Ckll., also found at Nasik, but the sculpture of the thorax is entirely different, especially that of the metathoracic area.

LXI. — *A Revision of the Pœciliid Fishes of the Genera Rivulus, Pterolebias, and Cynolebias.* By C. TATE REGAN, M.A.

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THE three closely related genera here dealt with are the neotropical Fundulinæ\*. In them the snout is short, the margin of the eyes is not free, and the gill-membranes are separate. The mouth is rather wide and transverse, with the præmaxillaries protractile, but not produced, and the lower jaw prominent and very oblique; the teeth are sub-conical, in bands, with an outer series of enlarged and spaced teeth, more or less canine-like, a lateral pair in the lower jaw being usually the strongest. The membrane connecting the præmaxillary with the lower jaw folds when the mouth is closed so as to fit into the right angle formed by the very narrow vertical præorbital and the horizontal nasal. The pectorals are placed low and the pelvics are not far in advance of the anal.

I give a list of the specimens in the British Museum collection, including the types of four species now described as new. Two of these, *Rivulus strigatus* from the Amazon and *Cynolebias nigripinnis* from the La Plata, have been

\* Except that a few species of the nearctic genus *Fundulus* occur in Central America.

I take this opportunity of proposing the new generic name *Petalurichthys*, to replace *Petalosoma*, Regan, 1908, as Mr. C. O. Waterhouse has kindly called my attention to the fact that this is preoccupied in Coleoptera (Lewis, Ann. & Mag. Nat. Hist. (7) xii. 1903, p. 418). There are two species of this neotropical Pœciliid genus, viz. *Petalurichthys cultratus*, Regan, 1908, and *P. amazonum*, Regan, 1911.

presented by Herr J. Paul Arnold, one, *Rivulus brevis* from Colombia, by Dr. W. Wolterstorff, and the fourth, *Cynolebias melanotenia* from Paranagua, by Herr A. Rachow.

# RIVULUS.

*Rivulus*, Poey, Mem. Cuba, ii. 1861, p. 307.

*Cynodonichthys*, Meek, Publ. Columbian Mus. Zool. v. 1904, p. 101.

In this genus the dorsal is shorter and further back than the anal. D. 6-11. A. 8-17. The pelvic fins are small. In the typical species the head is depressed and the body is subcylindrical anteriorly, moderately compressed posteriorly; sometimes (e. g. *R. brevis*) the fish is compressed throughout.

Twenty-two species from Central and South America, ranging from Cuba and Southern Mexico to the La Plata.

## Synopsis of the Species.

I. 45 to 52 scales in a longitudinal series.

- |  |                       |
|--|-----------------------|
| D. 10-11. A. 14-16. Dorsal origin twice as distant from eye as from base of caudal . . . . .                 | 1. <i>peruanus</i> .  |
| D. 9. A. 16-17. Dorsal origin twice or more than twice as distant from head as from base of caudal . . . . . | 2. <i>holmice</i> .   |
| D. 8-9. A. 11-12 . . . . .   | 3. <i>ocellatus</i> . |

II. 36 to 42 scales in a longitudinal series.

A. Anal ending below anterior part or middle of dorsal.

1. D. 6-8.

- |  |                          |
|--|--------------------------|
| A. 11-13. Dorsal origin more than twice as distant from head as from base of caudal. Caudal with ocellus in ♀, without pale or dark lower edge in ♂ . . . . .              | 4. <i>urophthalmus</i> . |
| A. 12-15. Dorsal origin about twice as distant from head as from base of caudal. Caudal without ocellus in ♀, with dark lower edge in ♂ . . . . .                          | 5. <i>elegans</i> .      |
| A. 11-12. Dorsal origin less than twice as distant from head as from base of caudal. Caudal with ocellus in ♀, with pale lower edge and dark intramarginal stripe in ♂ . . | 6. <i>godmani</i> .      |
| A. 11-12. Dorsal origin more than twice as distant from head as from base of caudal. Caudal as in <i>R. godmani</i> . . . . .  | 7. <i>tenuis</i> .       |

2. D. 9-10. A. 12-14 . . . . . 8. *flabellicauda*.

B. Anal ending below posterior part of dorsal.

- |   |                          |
|---|--------------------------|
| D. 10-11. A. 13 . . . . .   | 9. <i>cylindraceus</i> . |
| D. 9. A. 14. Dorsal origin $2\frac{1}{2}$ head-lengths behind head . . . . .    | 10. <i>micropus</i> .    |
| D. 8-10. A. 15-17. Dorsal origin less than 2 head-lengths behind head . . . . . | 11. <i>hartii</i> .      |

## III. 28 to 35 scales in a longitudinal series.

A. D. 6. 29 to 31 scales in a longitudinal series.

- A. 10-11, ending below first ray of dorsal, which is twice as distant from base of pectoral as from base of caudal ..... 12. *ornatus*.  
 A. 9-10; dorsal origin 3 times as distant from occiput as from base of caudal ..... 13. *atratus*.  
 A. 8; dorsal origin above middle of anal, 3 times as distant from middle of eye as from base of caudal ..... 14. *obscurus*.

B. D. 7-9. A. 10-13, ending below middle of dorsal. 32 to 35 scales in a longitudinal series.

- Dorsal origin twice as distant from head as from base of caudal ..... 15. *strigatus*.  
 Dorsal origin twice as distant from some part of eye as from base of caudal ..... 16. *geayi*.  
 Dorsal origin three times as distant from eye as from base of caudal ..... 17. *punctatus*.

C. D. 8-10. A. 11-14, ending below posterior part of dorsal.

a. A. 11 to 12. 31-33 scales in a longitudinal series.

- Dorsal origin twice as distant from head as from base of caudal ..... 18. *isthmensis*.  
 Dorsal origin equidistant from middle of pectoral and base of caudal; head  $3\frac{1}{2}$  in length of fish; pectoral nearly reaching pelvics ..... 19. *brasiliensis*.  
 Dorsal origin equidistant from middle of pectoral and base of caudal; head 4 in length of fish; pectoral not nearly reaching pelvics ..... 20. *breviceps*.

b. A. 14.

- 34 scales in a longitudinal series ..... 21. *balzanii*.  
 30 scales in a longitudinal series ..... 22. *brevis*.

1. *Rivulus peruanus*.*Haplochilus peruanus*, Regan, Ann. Mag. Nat. Hist. (7) xii. 1903, p. 626.

Depth of body about 5 in length, length of head about 4. Head broader than deep. Diameter of eye  $3\frac{1}{2}$  in the length of head. 45 to 47 scales in a longitudinal series. Dorsal 10-11; origin above middle of anal, twice as distant from eye as from base of caudal. Anal 14-16, ending below last 2 or 3 rays of dorsal. Pectoral  $\frac{2}{3}$  or  $\frac{3}{4}$  length of head, not reaching pelvics, which do not or barely reach the vent. Brownish, with darker longitudinal stripes along the series of scales and small dark spots on the vertical fins.

Peru.

1-2 (types). 55 mm.

Perim, Peru, 800 metres.

Simons.



2. *Rivulus holmiae*.

*Rivulus holmiae*, Eigenm. Ann. Carnegie Mus. vi. 1909, pp. 49, 50;

Mem. Carnegie Mus. v. 1912, pp. 452, 453, pl. lxiii. figs. 2, 3.

*Rivulus waimacui*, Eigenm. l. c. & t. c. pp. 452, 454, pl. lxiii. figs. 4, 5.

Depth of body about 5 in the length, length of head 4 to  $4\frac{3}{4}$ . Head broader than deep. Diameter of eye  $3\frac{1}{2}$  to 4 in the length of head. 46 to 50 \* scales in a longitudinal series. Dorsal 9; origin above posterior part of anal, at least twice as distant from head as from base of caudal. Anal 16-17, ending below middle or posterior part of dorsal. Pectoral  $\frac{3}{4}$  length of head, not extending to pelvics, which just reach vent. In spirit brownish, with darker spots which may become confluent to form longitudinal stripes, of which 3 on the tail are most prominent; vertical fins with series of small spots; caudal ocellus sometimes present. In life the back olive, sides olive or blue, belly white, yellow, or orange, spots or stripes red, brown, or purplish.

British Guiana.

1-2 (co-types). 50-60 mm.

Holmia.

Eigenmann.

3-4 (co-types of *R. waimacui*).

Shrimp Creek.

„

3. *Rivulus ocellatus*.

*Rivulus ocellatus*, Hensel, Arch. f. Nat. xxxiv. 1868, p. 365.

Depth of body  $4\frac{1}{2}$  to 5 in the length, length of head  $3\frac{3}{4}$  to 4. Head broader than deep. Diameter of eye  $3\frac{1}{3}$  to 4 in the length of head. 47 to 50 scales in a longitudinal series. Dorsal 8-9; origin above posterior part of anal, twice as distant from base of pectoral as from base of caudal. Anal 11-12, ending below anterior part of dorsal. Pectoral  $\frac{2}{3}$  or  $\frac{3}{4}$  the length of head, not extending to pelvics, which reach the vent. A dark spot (ocellated in ♀) on upper part of base of caudal, another above the pectoral; vertical fins more or less distinctly spotted; male with irregular dark cross-bands on body and with a blackish margin and pale intramarginal band to vertical fins.

Rio Janeiro; Santos.

1. 60 mm.

Santos

Arnold.

2-3. 40-45 mm.

„

Bartsch.

Dr. Pappenheim has very kindly informed me that the type has 48 to 50 scales in a longitudinal series, not 39 as stated in the original description.

\* Eigenmann counts 43 scales in *holmiae*, 46 to 52 in *waimacui*, but in co-types of the former I count 46 and 47, of the latter 47 and 50.

4. *Rivulus urophthalmus*:

*Rivulus urophthalmus*, Günth. Cat. Fish. vi. p. 327 (1866).

*Rivulus poeyi*, Steind. Sitzungsab. Akad. Wien, lxxiv. 1877, p. 165.

*Rivulus brasiliensis* (non Val.), Garman, Mem. Mus. Comp. Zool. xix. 1895, p. 135.

*Rivulus stagnatus*, Eigenm. Ann. Carnegie Mus. vi. 1909, pp. 49, 50; Mem. Carnegie Mus. v. 1912, pp. 453, 454, pl. lxiii. figs. 6, 7.

*Rivulus lanceolatus*, Eigenm. t. c. pp. 49, 51 & t. c. pp. 453, 455, pl. lxiv. fig. 1.

*Rivulus frenatus*, Eigenm. l. c. & t. c. pp. 453, 455, pl. lxiv. fig. 2.

Depth of body  $4\frac{1}{2}$  to  $5\frac{1}{2}$  in the length, length of head 4 to  $4\frac{1}{2}$ . Head broader than deep. Diameter of eye 3 to  $3\frac{2}{3}$  in the length of head. 37 to 42 scales in a longitudinal series. Dorsal 6-7; origin above last rays of anal, more than twice as distant from head, and  $2\frac{3}{4}$  to  $3\frac{1}{2}$  as distant from eye as from base of caudal fin. Anal 11-13, ending below anterior part or middle of dorsal. Pectoral  $\frac{3}{4}$  the length of head, not extending to pelvics, which just reach the vent. Olivaceous; each scale sometimes with a dark spot; sometimes longitudinal stripes between series of scales on sides; dorsal, caudal, and sometimes anal with series of small dark spots; caudal ocellus sometimes present (♀).

Amazon; Guiana.

1-5 (types). 35-50 mm.

Para.

6-8. 35-45 mm.

7-9 (co-types of *R. stagnatus*). 35-38 mm.

Christianburg.

Eigenmann.

„

This description was written from the Para specimens and was found to need no modification to include the co-types of *R. stagnatus*. *R. lanceolatus* is evidently the same species, the apparently different form of the caudal fin being due to the fact that it is less expanded. *R. frenatus* is said to have only 23 scales in front of the dorsal and the anal origin equidistant from base of caudal and præoperculum, but from the figure it would seem that there are about 29 scales from head to origin of dorsal fin and that the anal origin is equidistant from base of pectoral and base of caudal, as in small specimens of *R. urophthalmus* from Para, or in the co-types of *R. stagnatus*.

5. *Rivulus elegans*.

*Rivulus elegans*, Steind. Denkschr. Akad. Wien, xlii. 1880, p. 85, pl. vi. fig. 6.

Depth of body about 5 in the length, length of head about 4. Head broader than deep. Diameter of eye 3 to  $3\frac{1}{2}$  in the length of head. 36 to 40 scales in a longitudinal series. Dorsal 6-8: origin above posterior  $\frac{1}{3}$  of anal, about

twice as distant from head as from base of caudal, or  $2\frac{2}{3}$  to  $2\frac{3}{4}$  as distant from eye. Anal 12-15, ending below anterior part or middle of dorsal. Pectoral about  $\frac{2}{3}$  the length of head, not extending to pelvics, which usually just reach the vent. Olivaceous; often with dark longitudinal stripes between the series of scales; males with 3 dark longitudinal stripes on back from occiput and eyes to dorsal fin, which, in the females, are broken up into series of spots that generally extend transversely, forming a zigzag pattern; vertical fins plain, the caudal and anal with lower edge dark ( $\sigma$ ) or dorsal and caudal with series of small spots ( $\varphi$ ).

Colombia.

1-10. 25-55 mm.

R. Condoto, R. San Juan,  
S.W. Colombia.

Palmer.

### 6. *Rivulus godmani*.

*Rivulus godmani*, Regan, Ann. & Mag. Nat. Hist. (7) xix. 1907, p. 65, and Biologia Centr.-Am., Pisces, p. 82, pl. x. fig. 5.

Depth of body  $4\frac{1}{2}$  to 5 in the length, length of head  $3\frac{3}{4}$ . Head broader than deep. Diameter of eye 3 in the length of head. 36 scales in a longitudinal series. Dorsal 8; origin above posterior part of anal,  $2\frac{1}{5}$  to  $2\frac{1}{3}$  as distant from eye as from base of caudal fin. Anal 11-12, ending below middle of dorsal. Pectoral  $\frac{2}{3}$  length of head, not extending to pelvics, which reach the vent. Olivaceous, marbled with darker; a dark spot on each scale; operculum blackish; caudal with an ocellus ( $\varphi$ ) or with a pale lower-margin and dark intramarginal stripe ( $\sigma$ ).

Guatemala.

1-2 (types). 40 mm.

Guatemala.

Godman.

### 7. *Rivulus tenuis*.

*Cynodonichthys tenuis*, Meek, Publ. Columbian Mus. Zool. v. 1904, p. 101, fig. 27.

*Rivulus tenuis*, Regan, Biologia Centr.-Am., Pisces, p. 82 (1907).

Depth of body  $4\frac{1}{2}$  to 5 in the length, length of head 4 to  $4\frac{1}{2}$ . Head broader than deep. Diameter of eye  $3\frac{1}{3}$  to 4 in length of head. 38 scales in a longitudinal series. Dorsal 7-8; origin  $2\frac{3}{5}$  to 3 times as distant from eye as from base of caudal fin. Anal 11-12, ending below middle of dorsal. Pectoral  $\frac{2}{3}$  length of head, not extending to pelvics, which may reach vent. Olivaceous; back and sides sometimes marbled; operculum blackish; caudal with an

ocellus (♀) or with rather broad pale lower edge and dark intramarginal stripe (♂).

Southern Mexico.

- 1-2. 30-40 mm.  
3. 40 mm.

Coaxácoalcos.  
,,

Arnold.  
Bartsch.

### 8. *Rivulus flabellicauda*.

*Rivulus flabellicauda*, Regan, Ann. & Mag. Nat. Hist. (7) xix. 1907, p. 64; Biologia Centr.-Am., Pisces, p. 81, pl. x. fig. 6 (1907).

Depth of body  $4\frac{1}{2}$  in the length, length of head  $3\frac{1}{3}$ . Head broader than deep. Diameter of eye  $3\frac{1}{3}$  to 4 in the length of head. 40 to 42 scales in a longitudinal series. Dorsal 9-10; origin above posterior part of anal, twice as distant from præoperculum as from base of caudal fin. Anal 12-14, ending below middle of dorsal. Pectoral  $\frac{2}{3}$  the length of head; pelvics just reaching vent. Brownish; scales dark-edged; vertical fins with small spots; a caudal ocellus.

Costa Rica.

- 1 (type). 70 mm.  
2. 30 mm.

Juan Vinas.  
San José.

Underwood.  
Biolley.

### 9. *Rivulus cylindraceus*.

*Rivulus cylindraceus*, Poey, Mem. Cub. ii. 1861, p. 308; An. Soc. Esp. v. 1876, p. 140, pl. v. fig. 4, and ix. 1880, p. 247, pl. viii. fig. 1; Günth. Cat. Fish. vi. p. 327 (1866); Garman, Mem. Mus. Comp. Zool. xix. 1897, p. 134.

*Rivulus marmoratus*, Poey, Ann. Soc. Esp. ix. 1880, p. 248.

Depth of body about  $4\frac{1}{2}$  in the length, length of head  $3\frac{1}{2}$ . Head broader than deep. Diameter of eye  $4\frac{1}{2}$  in length of head. 38 or 39 scales in a longitudinal series. Dorsal 10-11; origin over middle of anal, twice as far from occiput as from base of caudal. Anal 13, extending back nearly as far as dorsal. Olivaceous, uniform or marbled; centres of scales darker; a caudal ocellus.

Cuba.

Total length 45 mm.

### 10. *Rivulus micropus*.

*Fundulus micropus*, Steind. Sitzungsab. Akad. Wien, xlviii. 1863, p. 184.

Depth of body about 5 in the length, length of head about  $4\frac{1}{3}$  ( $5\frac{1}{2}$  in total). Head broader than deep. Diameter of eye 4 in length of head. 41 scales in a longitudinal series. Dorsal 9; origin  $2\frac{1}{2}$  head-lengths from gill-opening. Anal 14, ending somewhat before the end of dorsal.



Pectoral as long as head without snout ; pelvics not nearly reaching anal. Brownish above, yellowish below ; vertical fins with series of small dark spots.

Rio Negro.

### 11. *Rivulus hartii*.

*Rivulus micropus* (non Steind.), Günth. Cat. Fish. vi. p. 327 (1866) ;

Garman, Mem. Mus. Comp. Zool. xix. 1895, p. 136.

*Haplochilus hartii*, Bouleng. Ann. & Mag. Nat. Hist. (6) vi. 1890, p. 190 ; Regan, Proc. Zool. Soc. 1906, i. p. 389, pl. xxi. fig. 2.

Depth of body  $4\frac{1}{2}$  to  $5\frac{1}{3}$  in the length, length of head  $3\frac{1}{2}$  to 4. Head broader than deep. Diameter of eye 3 to 4 in the length of head. 37 to 42 scales in a longitudinal series. Dorsal 8-10 ; origin above middle or posterior part of anal, twice as distant from some part of operculum as from base of caudal fin. Anal 15-17, ending below posterior  $\frac{1}{2}$  of dorsal. Pectoral about  $\frac{3}{4}$  the length of head, not extending to pelvics, which reach vent or origin of anal. Olivaceous ; sides with a red spot on each scale ; vertical fins usually orange, with or without small dark spots ; caudal ocellus often present.

Venezuela and neighbouring islands.

1-10 (types). 70 mm.

11, 12-15. 35-95 mm.

16-25. 75 mm.

26-27. 35 mm.

Trinidad.

"

Granada.

Venezuela.

Hart.

Guppy.

Wilton.

Dyson.

### 12. *Rivulus ornatus*.

*Rivulus ornatus*, Garman, Mem. Mus. Comp. Zool. xix. 1895, p. 139.

Form of the majority of the species. Length of head 4 in that of the fish. Diameter of eye 4 in length of head. 31 scales in a longitudinal series. Dorsal 6 ; origin twice as distant from base of pectoral as from base of caudal. Anal 10-11, ending below first ray of dorsal. Pectoral as long as head, nearly reaching pelvics, which do not reach anal. Puncticulations form blotches along the back, streaks along the sides, series of small spots on the fins, a band on the lower lip, and a streak backward from below each eye ; sometimes pale bands on the back meet dark vertical bars on sides.

Amazon.

Total length 35 mm.

13. *Rivulus atratus*.

*Rivulus atratus*, Garman, Mem. Mus. Comp. Zool. xix. 1895, p. 140.

Depth of the body 6 in the length, length of head 4. Head broader than deep. Diameter of eye  $3\frac{1}{2}$  in length of head. 31 scales in a longitudinal series. Dorsal 6; origin 3 times as distant from occiput as from base of caudal; base its length further back than that of anal. Anal 9-10. Pectoral nearly as long as head; pelvics very small, not reaching vent. Brownish; blackish below, with three vertical bands ascending respectively behind the pectorals, between pelvics and anal, and to the base of the dorsal; a dark stripe from eye round chin.

Jutahy.

14. *Rivulus obscurus*.

*Rivulus obscurus*, Garm. Mem. Mus. Comp. Zool. xix. 1895, p. 140.

Moderately slender, with the head broader than deep. Diameter of eye 3 in length of head. 29 scales in a longitudinal series. Dorsal 6; origin above middle of anal, 3 times as distant from middle of eye as from base of caudal. Anal 8, about half its base in front of dorsal. Pelvics hardly reaching anal. Back brownish, sometimes with darker blotches, among which there may be two series of pale blotches.

L. Hyanuary, Amazon.

15. *Rivulus strigatus*, sp. n.

Depth of body 5 in the length, length of head 4. Head broader than deep. Diameter of eye  $3\frac{1}{2}$  in the length of head. 33 scales in a longitudinal series. Dorsal 8; origin twice as distant from head as from base of caudal. Anal 12, ending below middle of dorsal. Pectoral  $\frac{2}{3}$  the length of head, not reaching pelvics, which extend to origin of anal. Olivaceous above, orange below; dark longitudinal stripes along series of scales on sides; irregular spots on back; dorsal, caudal, and posterior part of anal barred.

Amazon.

1 (type). 37 mm.

Amazon.

Arnold.

16. *Rivulus geayi*.

*Rivulus geayi*, Vaill. Bull. Mus. Paris, 1899, p. 156.

Depth of body  $4\frac{1}{2}$  to 5 in the length of head, length of

head  $3\frac{1}{2}$  to 4. Head broader than deep. Diameter of eye 4 in the length of head. 33 or 34 scales in a longitudinal series. Dorsal 7-9; origin twice as distant from some part of eye as from base of caudal. Anal 10-12, ending below middle of dorsal. Pectoral  $\frac{3}{4}$  length of head, not extending to pelvis, which reach origin of anal. A few dark bars or vertically expanded spots on the tail; dorsal and caudal fins usually spotted or barred.

French Guiana.

1-5 (co-types). 25-35 mm. Carsevenne. Paris Mus. (Coll. Geay).

### 17. *Rivulus punctatus*.

*Rivulus punctatus*, Bouleng. Boll. Mus. Torino, x. 1895, no. 196, p. 3.

Depth of body  $4\frac{1}{4}$  to  $4\frac{3}{4}$  in the length, length of head about 4. Head nearly as deep as broad. Diameter of eye about 4 in length of head. 32 to 35 scales in a longitudinal series. Dorsal 7-8; origin above posterior part of anal, 3 times as distant from eye as from base of caudal. Anal 12-13, ending below middle of dorsal. Pectoral  $\frac{3}{4}$  the length of head or a little more, sometimes almost reaching pelvis, which extend to the vent. A dark longitudinal band from chin through eye, sometimes continued to the tail; brownish above, yellowish below the band; small dark spots on sides, mostly forming series running obliquely downward and forward; vertical fins with series of spots; anal usually dark-edged.

La Plata.

1 (type). 20 mm.	Colonia Risso, Paraguay.	Borelli.
2. 30 mm.	Valenzuela, "	Barbero.
3-4. 30 mm.	Arroyo Yacá, "	"
5-7. 23-35 mm.	Urucu, Matto Grosso.	Genoa Mus.

### 18. *Rivulus isthmensis*.

*Rivulus isthmensis*, Garman, Mem. Mus. Comp. Zool. xix. 1895, p. 140.

Length of head  $3\frac{1}{3}$  in length of fish. Head depressed. Diameter of eye 3 in length of head. 32 scales in a longitudinal series. Dorsal 9; origin over middle of anal, twice as distant from head as from base of caudal. Anal 11, last ray nearly as far back as that of dorsal. Olivaceous; a dark blotch at base of dorsal, another on back above or in front of origin of anal.

Rio San José, Costa Rica.

19. *Rivulus brasiliensis*.

*Fundulus brasiliensis*, Val. in Humboldt, Observ. Zool. ii. p. 163, pl. lii. fig. 2 (1828); Cuv. & Val. Hist. Nat. Poiss. xviii. 1846, p. 200.

Depth of body 4 in the length, length of head  $3\frac{1}{2}$ . Diameter of eye about  $3\frac{2}{3}$  in the length of head. 30 or 31 scales in a longitudinal series. Dorsal 8; origin above anterior part of anal, equidistant from middle of pectoral and base of caudal. Anal 11, ending below end of dorsal. Pectoral almost reaching pelvics, which reach anal. Brownish; 9 or 10 blackish bars on lower part of body, from pelvic fin to caudal; dorsal dusky.

Brazil.

Total length  $2\frac{1}{2}$  inches.

I am indebted to Dr. Pellegrin for kindly informing me that he counts 30 or 31 scales in a longitudinal series in the types; this is quite a different species from *R. urophthalmus*.

20. *Rivulus breviceps*.

*Rivulus breviceps*, Eigenm. Ann. Carnegie Mus. vi. 1909, pp. 48, 49; Mem. Carnegie Mus. v. 1912, pp. 452, 453, pl. lxiii. fig. 1.

Depth of body  $4\frac{1}{3}$  in the length, length of head 4. Head broader than deep. Diameter of eye  $3\frac{1}{2}$  in length of head. 33 scales in a longitudinal series. Dorsal 9–10; origin above anterior part of anal, equidistant from middle of pectoral and base of caudal. Anal 11–12, ending below posterior part of dorsal. Pectoral  $\frac{5}{7}$  length of head, not extending to pelvics, which just reach anal. Brownish; a few vertical bars across middle rays of caudal.

British Guiana.

1 (co-type). 35 mm.

Shrimp Creek.

Eigenmann.

21. *Rivulus balzanii*.

*Haplochilus balzanii*, Perugia, Ann. Mus. Genova, (2) x. 1891, p. 653.

Depth of body 4 in the length, length of head 3. Head depressed. Diameter of eye 3 in length of head. 34 scales in a longitudinal series. Dorsal 9, originating above seventh ray of anal. Anal 14. Sides with 4 or 5 brownish longitudinal stripes, each covering a series of scales; dorsal and anal with 3 series of brown spots.

Villa Maria, Matto Grosso (Rio Paraguay).

22. *Rivulus brevis*, sp. n.

Depth of body  $3\frac{2}{3}$  in the length, length of head  $3\frac{2}{3}$ . Head



a little deeper than broad. Diameter of eye 3 in the length of head. 30 scales in a longitudinal series. Dorsal 9; origin in advance of middle of anal, twice as distant from eye as from base of caudal. Anal 14, ending below last 2 or 3 rays of dorsal. Pectoral  $\frac{3}{4}$  the length of head, extending beyond base of pelvics, which extend beyond origin of anal. Brownish, with a darker spot on each scale of upper part of sides; dorsal and anal barred; caudal dusky.

Colombia.

1 (type). 45 mm.

Colombia.

Wolterstorff.

### PTEROLEBIAS.

Garman, Mem. Mus. Comp. Zool. xix. 1897, p. 141.

This genus appears to differ from *Rivulus* in the deep, strongly compressed tail, with sharp lower edge, and in the elongate fin-rays, the pelvics extending to the posterior end of the anal.

#### 1. *Pterolebias longipinnis*.

*Pterolebias longipinnis*, Garman, Mem. Mus. Comp. Zool. xix. 1897, p. 142.

Dorsal 9-10. Anal 19-20. 31 or 32 scales in a longitudinal series. Brownish; fins spotted.

Santarem.

Total length 80 mm.

### CYNOLEBIAS.

Steind. Sitzungsab. Akad. Wien, lxxiv. 1876, p. 172.

This genus differs from *Rivulus* in the subequal many-rayed dorsal and anal fins; the species are deeper and more compressed than most of the *Rivuli*.

### *Synopsis of the Species.*

I. Pectoral fin not extending beyond origin of anal, which is nearly below that of the dorsal, nearer to base of caudal fin than to end of snout.

A. Pelvics not reaching anal.

28 scales in a longitudinal series. D. 16-18. A. 17-20. 1. *melanotænia*.  
45 to 50 scales in a longitudinal series. D. 17. A. 20. 2. *elongatus*.

B. Pelvics extending beyond origin of anal; 28 to 30 scales in a longitudinal series. D. 17-19. A. 22-26.... 3. *maculatus*.

## II. Pectoral fin extending beyond origin of anal.

A. Dorsal origin behind that of anal, nearly equidistant from end of snout and base of caudal, or nearer the latter.

- D. 18. A. 20. 40 scales in a longitudinal series .... 4. *porosus*.  
 D. 22. A. 24. 33 scales in a longitudinal series .... 5. *robustus*.  
 D. 21-24. A. 26-30. 28 to 30 scales in a longitudinal series ..... 6. *bellottii*.

B. Dorsal origin a little in advance of that of anal, nearer to end of snout than to base of caudal. D. 26. A. 25. 28 scales in a longitudinal series ..... 7. *nigripinnis*.

1. *Cynolebias melanotænia*, sp. n.

Depth of body  $3\frac{1}{2}$  to  $4\frac{1}{2}$  in the length, length of head  $3\frac{1}{4}$  to  $3\frac{1}{2}$ . Caudal peduncle longer than deep. Diameter of eye 3 in the length of head. 28 scales in a longitudinal series. Dorsal 16-18, origin above that of anal, equidistant from some part of eye and base of caudal. Anal 17-20. Dorsal and anal rather elevated posteriorly. Pectoral shorter than head, not reaching anal; pelvics small, not reaching anal. A blackish lateral band from lower jaw through eye to base of caudal, another at base of anal continued forward to base of pectoral, sometimes a third on the back; vertical fins usually spotted.

S.E. Brazil.

1-9 (types). 32-37 mm.

Paranagua.

Rachow.

2. *Cynolebias elongatus*.

*Cynolebias elongatus*, Steind. Denkschr. Akad. Wien, xliv. 1882, p. 11.

Depth of body  $3\frac{1}{3}$  in the length, length of head 3. Caudal peduncle longer than deep. Diameter of eye 6 in length of head. 45 to 50 scales in a longitudinal series. Dorsal 17; origin equidistant from præoperculum and base of caudal; posterior rays longest,  $\frac{1}{2}$  length of head. Anal 20; origin scarcely in advance of that of dorsal; middle rays longest, rather shorter than longest rays of dorsal. Pectoral as long as postorbital part of head, extending to middle of pelvics, which reach the vent. Brownish; a dark vertical bar through eye; vertical fins spotted.

La Plata.

1. 140 mm.

La Plata.

Arnold.

### 3. *Cynolebias maculatus.*

*Cynolebias maculatus*, Steind. Denkschr. Akad. Wien, xlv. 1882, p. 10, pl. v. fig. 2; Garman, Mem. Mus. Comp. Zool. xix. 1897, p. 145.

Depth of body 3 in the length, length of head  $3\frac{1}{3}$  to  $3\frac{2}{3}$ . Caudal peduncle longer than deep. Diameter of eye nearly 4 in the length of head. 28 to 30 scales in a longitudinal series. Dorsal 17-19; origin nearly above that of anal, about equidistant from eye and base of caudal; posterior rays longest,  $\frac{3}{4}$  or  $\frac{4}{5}$  length of head. Anal 22-26; middle rays as long as longest of dorsal. Pectoral  $\frac{3}{4}$  length of head, extending to anterior part or middle of pelvics, which reach beyond origin of anal. Olivaceous; a dark stripe below eye; vertically expanded violet spots on body and vertical fins.

La Plata.

1-3. 55-60 mm.

La Plata.

Doria.

4. 47 mm.

„

Arnold,

### 4. *Cynolebias porosus.*

*Cynolebias porosus*, Steind. Sitzungsab. Akad. Wien, lxxiv. 1876, p. 173, pl. x. fig. 3; Garman, Mem. Mus. Comp. Zool. xix. 1897, p. 143.

Depth of body nearly equal to length of head, about 3 in the length of fish. Caudal peduncle nearly as long as deep. Diameter of eye 5 in length of head. 40 scales in a longitudinal series. Dorsal 18; origin equidistant from præoperculum and base of caudal; posterior rays longest,  $\frac{3}{5}$  length of head. Anal 20; origin equidistant from anterior margin of eye and base of caudal; posterior rays longest, nearly as long as head. Pectoral  $\frac{4}{5}$  length of head, extending beyond origin of anal; pelvics extending beyond origin of anal. Brownish; fins greyish.

Pernambuco.

Total length 75 mm.

### 5. *Cynolebias robustus.*

*Cynolebias robustus*, Günth. Ann. & Mag. Nat. Hist. (5) ii. 1883, p. 140.

Depth of body  $2\frac{2}{3}$  in the length, length of head  $3\frac{2}{3}$ . Caudal peduncle deeper than long. Diameter of eye  $5\frac{1}{2}$  in the length of head. 33 scales in a longitudinal series. Dorsal 22; origin equidistant from middle of eye and base of caudal; posterior rays longest,  $\frac{2}{3}$  length of head. Anal

24; origin considerably nearer to end of snout than to base of caudal; middle rays as long as longest of dorsal. Pectoral as long as postorbital part of head, extending beyond origin of anal. Brownish, with indistinct cross-bars; a dark bar below eye; small pale blue spots on dorsal and anal fins.

La Plata.

1 (type). 92 mm.

San Antonio.

Gibson.

### 6. *Cynolebias bellottii*.

*Cynolebias bellottii*, Steind. Denkschr. Akad. Wien, xlv. 1882, p. 9, pl. v. fig. 3; Garman, Mem. Mus. Comp. Zool. xix. 1897, p. 144.

Depth of body  $2\frac{1}{3}$  to 3 in the length, length of head  $3\frac{1}{2}$  to  $3\frac{2}{3}$ . Caudal peduncle deeper than long. Diameter of eye 4 in the length of head. 28 to 30 scales in a longitudinal series. Dorsal 21-24; origin nearly equidistant from end of snout and base of caudal; posterior rays longest,  $\frac{1}{2}$  to  $\frac{2}{3}$  length of head. Anal 26-30; origin about equidistant from end of snout and end of its own base; middle rays as long as longest of dorsal. Pectoral  $\frac{3}{4}$  or  $\frac{4}{5}$  length of head, extending beyond origin of anal. Brownish; a dark vertical stripe through eye; fins violet; vertical series of pale spots sometimes present on body and fins.

La Plata.

1-2. 65 mm.

La Plata,

Doria.

3. Skel,

"

"

4-5. 55-60 mm.

„

Arnold.

### 7. *Cynolebias nigripinnis*, sp. n.

Depth of body  $3\frac{1}{4}$  in the length, length of head  $3\frac{3}{4}$ . Caudal peduncle nearly as long as deep. Diameter of eye  $3\frac{1}{3}$  in the length of head. 28 scales in a longitudinal series. Dorsal 26; origin a little nearer to end of snout than to posterior end of its own base. Anal 25; origin a little behind that of dorsal. Dorsal and anal rays increasing in length posteriorly, the longest  $\frac{3}{4}$  the length of head. Pectoral a little shorter than head, extending beyond origin of anal. Olivaceous; a dark bar between and below eyes; fins bluish black; some small pale spots on body and fins.

La Plata.

1 (type). 45 mm.

La Plata.

Arnold.



LXII.—*New Species of Heterocera from Costa Rica*.—XVIII.

By W. SCHAUS, F.Z.S.

## Noctuidæ.

*Calymniodes maneti*, sp. n.

♂. Palpi and vertex black; frons brown-black. Collar and thorax reddish brown. Abdomen fuscous grey; anal hairs buff and brown. Fore wings mostly slate-colour; a light brown shade from base of costa to antemedial on inner margin, interrupted in cell, crossed on costa and just below cell by a dark brown line; antemedial line reddish brown, outcurved on inner margin, finely edged with black-brown; medial space shaded with light brown on costa and before postmedial line, the inner margin similarly irrorated; orbicular broadly circled with buff-brown, followed by a fuscous shade outbent from costa to median, then downturned; reniform oblique, light brown, containing two darker brown lines suffusing in front and behind; a dark brownish slate shade beyond cell filling angle of postmedial; postmedial fine velvety black-brown, angled at vein 6, vertical from vein 4 to inner margin; the veins on outer space irrorated with grey; terminal whitish points at veins; a light brown shade at apex, also subterminally from vein 4 to tornus. Hind wings fuscous grey, tinged with brown, darkest terminally; a large fuscous discal spot; cilia dirty white crossed by a dark line at base. Hind wings below whitish irrorated with brown especially on costa and apex; discal spot large, black; a dark postmedial line, inbent at vein 2; a terminal fuscous shade between veins 4 and 6.

Expanse 28 mm.

*Hab.* Juan Vinas.*Vespola plumipes*, sp. n.

Very similar to *V. cæruleifera*, Wlk., but larger, and the postmedial line more deeply incurved below vein 4. The abdomen below is entirely black in both sexes and the hind tibiæ of male are dilated and fringed with long hairs.

Expanse, ♂ 44 mm., ♀ 40–43 mm.

*Hab.* Sixola, Tuis.*Acidaliodes infantilis*, sp. n.

♀. Body and wings greyish; collar shaded with roseate brown; abdomen with transverse roseate-brown shades, and

black dorsal tufts at base, middle, and end. Wings crossed by antemedial, medial, postmedial, and subterminal roseate-brown shades; terminal black spots. Fore wings: small clusters of black scales on costa, cell, fold, and inner margin of antemedial and postmedial shades. Fore wings below fuscous grey. Hind wings below whitish; a faint subterminal fuscous shade, and medial shade on costa.

Expanse 12 mm.

*Hab.* Esperanza.

*Thyriodes terrabensis*, sp. n.

♂. Palpi, head, and collar dark brown irrorated with white. Thorax dark purplish grey, the patagia edged with dark brown. Abdomen similar, the dorsal tufts dark brown. Fore wings dark purplish grey; diffuse basal and subbasal brown shades; antemedial fine, outangled, followed by a small fuscous triangular spot on costa, and a larger one on inner margin, the latter with inner edge oblique, outer edge vertical, posterior edge excurved; a vertical fuscous medial shade; postmedial fuscous, fine, sinuous, and outangled just below vein 6, lunular from vein 3 to inner margin, followed on costa by a fine white line and fuscous brown shade, which are both upturned towards costa at vein 6; a dark brown terminal lunular line. Hind wings fuscous brown with some darker scaling at anal angle; a pale line at base of cilia. Fore wings below grey-brown, shaded with clearer brown towards apex; costa to postmedial line thickly irrorated with white; postmedial white, macular on costal margin; three white points and a white subterminal streak on costa. Hind wings below brown, streaked with whitish grey on inner margin; a postmedial whitish line, distinct only on inner margin; cilia on both wings mottled with white below.

Expanse 27 mm.

*Hab.* Terraba.

Near *T. dissimilis*, Dr.; darker, more uniformly coloured.

*Homoptera excellens*, sp. n.

♂. Palpi brownish buff shaded above with black. Head, collar, and thorax pale rufous, with some white mottling posteriorly on thorax. Abdomen buff irrorated with dark grey. Fore wings: base brown, crossed by a subbasal and antemedial paler line, the former inwardly edged with fuscous on costa; a fuscous streak at base of inner margin; medial space inwardly broadly greyish buff, partly mottled with pale greenish scales, and containing a minute black point in cell,

outwardly brown shaded and crossed by two dark brown lines, dentate on vein 2 and submedian, closely followed by the blue-green and narrow reniform; postmedial space lilacine buff, crossed by a dentate brown shade and limited by a fine, outcurved, sinuous, black line, lunular from vein 4 to inner margin; this line is outwardly edged with whitish on costa and is followed by a narrow dark brown space expanding on costa, where it contains three small white spots, and above inner margin it is partly shaded with lighter brown, its outer edge is slightly incurved from costa to vein 4, angled, and more deeply incurved to inner margin, being followed by a bluish-green shade; outer margin broadly lilacine, darkest terminally; terminal fuscous spots between veins, connected by a fine black lunular line, the spot above tornus the largest; cilia brown. Hind wings buff-brown; an angled fuscous line on discocellular; three dark lines postmedially, followed by a fine black line; a subterminal, narrow, fuscous shade from vein 6 to tornus, inwardly pale shaded, outwardly with pale green; the termen below vein 6 as on fore wings. Wings below buff, shaded with brown and irrorated with darker brown; small black discal spots; outer line lunular, fuscous; two dark medial lines on fore wings, three postmedially on hind wings.

Expanse 43 mm.

*Hab.* Juan Vinas.

*Campometra guapila*, sp. n.

♂. Head, collar, and thorax dark brown, mottled with reddish and buff-brown. Abdomen fuscous brown; a broad black transverse shade at base. Fore wings brown, shading to fuscous brown on inner margin and on postmedial space; a subbasal light brown shade crossed by a fine black line; antemedial line fine, black, vertical, wavy, followed by a small fuscous spot on costa; orbicular very small, fuscous; some reddish-brown irrorations in cell; reniform indistinct, crossed by a pale line outwardly shaded with fuscous; postmedial line very indistinct, dentate, defined by pale shading on costa and there preceded by a fuscous spot, the space beyond fuscous brown suffusing with the dentate subterminal black shade; terminal space grey-brown thinly irrorated with dark red, the veins shaded with dark grey; marginal black spots inwardly shaded with whitish; a wavy terminal fuscous line. Hind wings fuscous brown, limited by the subterminal dentate black line, which is outwardly dentate

between veins 7 and 6, and slightly incurved between 5 and 2; terminal space as on fore wings; cilia fuscous grey, mottled with brown and red. Wings below fuscous grey tinged with brown; a faint postmedial line; cilia fuscous grey, spotted with whitish. Fore wings: some fuscous spots on costa separated by smaller buff spots. Hind wings: a faint dark line on discocellular.

Expanse 42 mm.

*Hab.* Guapiles, Avangarez.

Near *C. bidens*, Kaye.

*Campometra obsolefacta*, sp. n.

♂. Palpi fuscous, thinly irrorated with buff. Frons medially brownish buff, laterally fuscous brown; vertex, collar, thorax, and base of abdomen fuscous brown, thinly irrorated with buff. Abdomen buff-grey, irrorated with reddish brown; a long fuscous dorsal tuft between third and fourth segments. Fore wings: base black, slightly mottled with buff just below cell, crossed by a fine velvety subbasal line, and limited by a dentate antemedial line, the angles scaled with buff; medial space buff irrorated with reddish brown, the veins dark grey; a black dot as orbicular; reniform very faintly outlined in fuscous grey; postmedial line very fine, fuscous, irregular and barely traceable, preceded on costa by a fuscous spot, and shaded with white on subcostal; terminal space fuscous brown; traces of a subterminal black line, outwardly dentate on interspaces; an interrupted marginal black line, preceded by some lighter brown shading at vein 5; a wavy dark brown terminal line. Hind wings buff irrorated with reddish brown; costal margin broadly, inner margin narrowly, and a streak from base to termen below cell and vein 2 fuscous grey; postmedial line black dentate; marginal and terminal lines as on fore wing; the subterminal space shaded with fuscous brown and with traces of a line. Wings below slate-grey; faint medial and postmedial darker lines. Female fuscous brown; basal and terminal spaces blue-black; the lines velvety black, more distinct; the postmedial shaded with bluish white at subcostal, and with light brown near inner margin; the subterminal outwardly shaded with light brown; reniform indicated by buff-brown shading; intervenal buff spots preceding marginal line, the largest at vein 5. Hind wings dark brown irrorated and shaded with fuscous; streak below cell and inner margin fuscous; the subterminal line very distinct, dentate; the marginal line preceded by buff shading.



Wings below dark greyish brown; subterminal fuscous shading; fine pale discal lines; the two lines on hind wings more distinct; whitish buff shades on termen at vein 5; buff costal spots on fore wing beyond a medial black spot.

Expanse, ♂ 42 mm., ♀ 44 mm.

*Hab.* La Florida, Sixola.

*Hemeroblemma stiva*, sp. n.

♀. Palpi fuscous irrorated with yellowish and grey. Head dark brown irrorated with grey. Collar brown. Thorax brownish buff. Abdomen fuscous. Fore wings: anterior portion from inner margin before base to termen at vein 5 buff irrorated with fuscous, the postmedial space palest; posterior portion of wing dark brown; antemedial fine, fuscous, inset in cell; orbicular small, round, dark brown mottled with buff and circled with clear buff; reniform bluntly oval, outlined in fuscous; postmedial fine, dentate, fuscous, followed by a similar shade on costa; an outer fine dentate line, slightly inbent at vein 4, thicker, vertical, and almost straight to inner margin, outwardly edged on dark space by a greyish-brown shade, and then followed by a broad yellowish-buff line from vein 4 to inner margin; a subterminal fuscous spot above vein 7, followed by a very faint dentate line, paler shaded and macular below vein 5; marginal black and white spots on interspaces; a buff shade at tornus. Hind wings dark brown, the lines fuscous; antemedial and medial lines wavy, coarse; postmedial fine, lunular dentate; subterminal shade, followed by a paler brown shade at apex; a dentate lunular marginal line, outwardly shaded with buff-brown. Wings below greyish thickly irrorated with brown; black discal points; basal half dark shaded. Fore wings: medial and postmedial lines broad; outer line remote, finer; subterminal partly macular. Hind wings: outer line broad and close to postmedial; subterminal coarse, continuous; the marginal lines with white shading in angles.

Expanse 65 mm.

*Hab.* Juan Vinas.

*Hypogramma auripennis*, sp. n.

♂. Palpi streaked black and whitish. Head, collar, and thorax black, mottled with white and greenish-white scales; patagia dull green. Abdomen to just beyond middle golden yellow, with a large fuscous basal tuft tipped with metallic.

copper-colour and gold, and followed by a smaller black spot; terminal segments fuscous; anal hairs buff-brown. Fore wings dull olive-green, mottled with grey on costa and medially; an antemedial fuscous shade, expanding to base above and below submedian, limited inwardly by a vague dark line and paler basal space, and outwardly by a geminate fuscous line; a brownish line on discocellular inwardly pale edged and followed by a black spot; a black shade on costa above discocellular and one below it; postmedial geminate, lunular dentate, outcurved beyond cell; black intervenal streaks from postmedial to termen, interrupted by greyish scales subterminally; the whole terminal space beyond postmedial irrorated with whitish-grey scales and some orange-brown scales. Hind wings golden yellow, the costal margin broadly dull olive-green mottled like fore wings. Fore wings below fuscous; a black streak at base of costa; a postmedial thick black line. Hind wings below golden yellow; the apex black, preceded by a short dentate black line.

Expanse 38 mm.

*Hab.* Sitio, Sixola.

*Concana? permixta*, sp. n.

♀. Palpi light brown, the second joint tipped with fuscous. Frons grey, crossed above by a black line; vertex brown. Collar light brown, shaded with white behind. Thorax dark brown; patagia light brown mottled with grey. Abdomen buff with dark brown segmental lines. Fore wings: basal half brownish buff, limited by an outcurved dark brown fascia; some subbasal steel-grey shading on costa and inner margin; a light brown antemedial space widest on costa and extending just below median, followed on costal margin by some white scaling crossed by a fine black line; medial fascia interrupted in cell by a light brown spot edged with black, except behind, followed by a steel-grey shade, a fine black line, and a brown shade, terminating at discocellular; postmedial space beyond cell and on costa pale brownish white, narrowing from vein 3 to inner margin, crossed by the postmedial line, which is oblique from costa to vein 6, angled and inturned to some black scaling, then outcurved, and irregularly indented to inner margin, followed throughout by a pale shade and then the dark brown subterminal shading; apex shaded with steel-grey; some terminal dark grey shading at veins 4 and 2 and a creamy white shade between them; some marginal dark brown spots. Hind wings dark brown; a darker terminal line

interrupted by pale streaks on veins. Fore wings below brown; a dark postmedial line outcurved beyond cell, and outwardly shaded with white from costa to vein 4. Hind wings below white; the costal half shaded with brown; a large discal spot crossed by a pale line; a dentate postmedial line and a subterminal shade; terminal line as above.

Expanse 26 mm.

*Hab.* Avangarez.

*Herminodes latris*, sp. n.

♀. Palpi fuscous brown, edged with whitish above. Head and collar whitish. Thorax greyish. Abdomen above dull grey, underneath whitish grey. Fore wings buff-grey, thinly irrorated with light brown; a minute dark point on discocellular; a faint postmedial outcurved row of short dark streaks, followed by a similar lunular dentate line; terminal black spots on interspaces. Hind wings dull grey tinged with brown; the costal margin paler. Fore wings below dull greyish; a faint whitish streak in cell. Hind wings below whiter.

Expanse 33 mm.

*Hab.* Tuis.

*Herminodes iphis*, sp. n.

♂. Palpi inwardly buff, outwardly brown. Head, collar, and thorax buff, with a few scattered black-brown scales. Abdomen brown-buff, thickly irrorated with brown scales. Fore wings buff, thinly irrorated with brown and black; a black point at end of cell; orbicular round, black; reniform forming a broad black lunule; the two spots connected by a black bar close to median; an elongated black spot below the bar; the irrorations form a postmedial line of minute spots outangled beyond cell; subterminal small spots below vein 2, between veins 4 and 5, and 5 and 6; terminal black spots on interspaces. Hind wings fuscous, somewhat mottled with buff on termen; cilia buff.

Expanse 36 mm.

*Hab.* Tuis.

Near *H. tripuncta*, Schs.

*Plynteria florens*, sp. n.

♂. Head, collar, and thorax brown, the scales paler tipped. Abdomen brown, anal hairs yellowish. Wings brown, somewhat silky; cilia darker, with whitish points at veins. Fore wings: an antemedial and postmedial small white spot

on costa; antemedial and postmedial lines darker brown faintly edged, the former inwardly, the latter outwardly, with whitish-grey scales, the antemedial vertical, the postmedial outcurved beyond cell; a minute grey spot in middle of cell; some white scales on discocellular; a faint subterminal darker brown shade. Hind wings: a very faint postmedial lunular line, slightly shaded with white in the female. Wings below dark greyish, with faint traces of lines and discocellular streaks.

Expanse 17 mm.

*Hab.* Sixola.

*Plynteria costata*, sp. n.

♂. Palpi, head, collar, and thorax brown, the collar edged behind by a white line. Abdomen fuscous, anal hairs pale. Wings brown; small white discal spots; a faint darker subterminal shade, outwardly edged with lighter brown intervenal spots; minute terminal pale points at veins; cilia fuscous. Fore wings: the basal half except costal margin tinged with iridescent purple; a greyish-white line along costa. Wings below rather paler brown; a faint subterminal fuscous shade and pale terminal points; hind wings with small fuscous discal spot and postmedial line. Female without purple shading on fore wing; the costal line more pronounced, whitish edged in front with yellow.

Expanse, ♂ 23 mm., ♀ 26 mm.

*Hab.* Carillo, Tuis, Sixola.

*Plynteria stellata*, sp. n.

♂. Antennæ finely ciliated. Head, collar, and thorax brown, the scales faintly tipped with greyish. Abdomen fuscous; a white dorsal point on second segment; anal hairs light brown. Wings brown, the markings white; terminal white points at veins, extending on cilia. Fore wings: an antemedial line of small spots, slightly inbent from costa; an orbicular point; reniform consisting of an incurved line followed by a large spot surmounted by a point; a costal spot above it; postmedial consisting of small spots and fine lunules, inset opposite cell and incurved to middle of inner margin; irregular subterminal spots and irrorationes, the largest on costa, above veins 7 and 5, and at fold. Hind wings: a faint fuscous discal point; postmedial whitish lunules, incurved near inner margin. Wings below fuscous grey, the hind wings irrorationed with whitish grey,



defining a postmedial dark line, and fainter subterminal shade.

Expanse 23 mm.

*Hab.* Carillo, Sixola.

*Obroatis gatena*, sp. n.

♂. Palpi purplish brown, streaked above with red. Head, collar, and thorax brown tinged with lilacine. Abdomen above dull grey shaded with lilacine brown hairs; underneath pale red. Legs with pale red hairs; the tarsi dark brown circled with white. Wings roseate brown with scattered black irrorations. Fore wings: orbicular and reniform small, greenish grey finely edged with brown and faint lilacine white lines; postmedial fine, fuscous, oblique from costa, inbent from above vein 5 to middle of inner margin; termen from above vein 3 broadly dark shaded and more thickly irrorated with black; marginal white points connected by a deeply lunular black line. Hind wings: a straight medial line; faint white marginal points, but without connecting line. Wings below shaded with pale red, especially on veins; black discal points; cilia fuscous brown. Fore wings: inner margin greyish white; a dark medial line on inner margin; a faint lunular outer line. Hind wings: a dark medial line.

Expanse 42 mm.

*Hab.* Sixola.

Near *O. negata*, Wlk.

*Obroatis ? gargilius*, sp. n.

♂. Palpi fuscous grey. Head dark brown. Collar and thorax greyish brown tinged with reddish. Abdomen brownish grey. Fore wings: base lilacine with a few darker irrorations; costa reddish brown; a fine, dark brown antemedial line, outcurved on costa, vertical below cell; medial space reddish brown, darkest towards postmedial line; a dark point as orbicular; reniform narrow, outlined in dark brown; postmedial line outbent on costa, nearly vertical from vein 6 to inner margin, lilacine, edged with fuscous brown which expands outwardly to apex; outer margin lilacine, irrorated with fuscous brown and crossed by brown veins; a terminal fine lunular line; cilia brownish grey; some subterminal white scales above and below vein 5. Hind wings brownish grey; a postmedial fuscous line, partly geminate; a broad terminal fuscous shade; the veins outwardly irrorated with brown. Wings below buff, shaded

with fuscous and irrorated with grey-brown; fuscous discal spots and postmedial line; termen and inner margin of fore wing narrowly pale, inner margin of hind wings broadly so; a fine dark terminal line.

Expanse 44 mm.

*Hab.* Poas.

*Argidia aufidia*, sp. n.

♂. Palpi deep olive-yellow. Head, collar, and thorax dark greyish brown, mottled with fine lilacine hairs; abdomen above brighter, underneath reddish orange. Fore legs brown irrorated with lilacine; hind tibia with long tufts of yellow-brown hairs. Wings pale olive-brown. Fore wings: base to medial line shaded with lilacine grey; antemedial fine, dark brown, shaded with lilacine, outbent on costa, inset on subcostal, outwardly curved to submedian, and deeply outcurved on inner margin; orbicular dull lilacine, finely circled with dark brown; medial line broad on costa, dark brown, suffusing with reniform, finer, fuscous, inbent to submedian, and outcurved on inner margin; reniform very large, like a large "8," finely outlined in darker brown; costa above reniform and towards apex tinged with roseate lilacine; outer line oblique from costa, crossing a dull brown shade, on which it is darker marked, below vein 7 inbent, fine, and nearly black; postmedial space to outer line brighter brown; outer line closely followed from vein 6 to inner margin by a fuscous line on a pale ground; subterminal indistinct, dentate lunular, marked by black spots between veins from 3-6. Hind wings: a fuscous medial line; outer line as on fore wings; outer margin broadly irrorated with lilacine; subterminal whitish points; termen narrowly and cilia very dark brown. Fore wings below olive; costa to outer line broadly lilacine, then to apex orange-brown; medial line nearly straight; outer line fine, purple-black; a subterminal fine line; inner margin yellowish; orbicular and reniform lilacine. Hind wings below orange, finely irrorated with dull brown; a medial black line; a postmedial black and purple-red line; a fine black subterminal line.

Expanse 48 mm.

Female: body and wings yellow-brown tinged with roseate, the lilacine shadings more roseate; the lines as in male. Underneath brighter than male, especially the fore wings.

Expanse 49 mm.

*Hab.* Juan Vinas, Sitio.

*Empelathra pindarus*, sp. n.

♂. Palpi fuscous, third joint irrorated with buff. Body and wings reddish brown tinged with lilacine. Abdomen with fine lilacine-white segmental lines. Fore wings: lines darker reddish brown; the antemedial vertical, preceded by whitish spots on veins; orbicular rather large, consisting of an annular whitish line; a medial darker shade; some darker shading at and beyond end of cell, but no reniform; postmedial outcurved beyond cell, marked by white points on veins, terminating as a white line on inner margin, where it is preceded by a few lilacine white irrorations; subterminal dark points with some white irrorations between veins and heavily shaded with whitish grey from vein 4 to apex, forming a broad line; small marginal clusters of white scales between veins and terminal white points at veins. Hind wings: costa shaded with grey; a broad medial lighter brown shade from cell to inner margin, where it is mottled with grey, and edged by two dark reddish-brown lines, the outer line followed by white points; subterminal, marginal, and terminal points as on fore wings, but less distinct and without any broad grey shading.

Expanse 36 mm.

*Hab.* Juan Vinas.

*Dagassa ? atalanta*, sp. n.

♀. Palpi whitish buff, irrorated with dark purple. Head and collar buff irrorated with brown, the latter shaded with brown behind. Thorax dark grey, the patagia shaded with brown. Abdomen dull brown; a black transverse line at base; grey segmental lines, broadest terminally; anal hairs buff. Wings dull brown, shaded with purplish grey from base to postmedial line; a black-brown terminal line. Fore wings: costa buff, finely striated with fuscous to postmedial, then finely black with the usual buff spots; lines dark brown, the antemedial wavy, inbent in cell, followed by a small orbicular black spot; medial line wavy, outcurved in cell; reniform consisting of an inbent dark line edged with greyish; postmedial line slightly outcurved, geminate, filled in with purplish grey; very faint traces of subterminal spots; cilia shaded with buff from vein 3 to tornus. Hind wings: a fine dark brown antemedial line; a black discal point; postmedial geminate as on fore wings; cilia buff at base, then fuscous tipped with white. Wings below greyish striated with fuscous, the lines fine, also fuscous. Fore

wings: outer half faintly shaded with brown, except on costa and inner margin; an antemedial black spot in cell; medial and postmedial lines outbent on costal third, then sinuous; a terminal fuscous shade above vein 4, interrupted between vein 6 and 7 by pale mottlings. Hind wings: a dark discocellular spot followed by a medial and postmedial wavy line; some marginal fuscous shading at apex.

Expanse 30 mm.

*Hab.* Tuis.

*Euthermesia blandida*, sp. n.

♀. Palpi brown irrorated with black, third joint black, the second and third tipped with white. Head, collar, and thorax brown; some white shading on patagia in front. Abdomen fuscous brown, with pale segmental lines. Wings brown, faintly tinged with red; a lunular darker terminal line; cilia broadly tipped with fuscous opposite interspaces. Fore wings: a lilacine streak from base to apex close above subcostal; extreme costa finely fuscous brown; a faint inbent darker antemedial line, marked by lilacine points on veins; postmedial line slightly curved on costa, then straight and inbent, dark brown, outwardly edged with yellowish and with lilacine points on veins; a dark brown shade on discocellular in front with a small lilacine spot; a wavy series of subterminal fuscous spots outwardly shaded with lilacine. Hind wings: an antemedial lilacine spot on median and near inner margin; dark discal spots; postmedial line straight, as on fore wings; subterminal spots similar, the spot between veins 5 and 6 inset. Wings below light greyish brown; small fuscous discal spots; subterminal fuscous spots parallel with termen.

Expanse 28 mm.

*Hab.* Tuis.

*Mulelocha celita*, sp. n.

♀. Palpi mottled brown and buff, the third joint dark except tips and base which are buff-white. Head and collar brown, the tegulae edged with dull grey. Thorax buff, narrowly shaded with dark brown in front. Abdomen fuscous grey, the second segment darker with a white dorsal point. Fore wings buff, the costal margin duller and striated with fuscous; a whitish lunule edged with dark brown on discocellular; from below discocellular and vein 3 a fuscous brown space to inner margin, expanding towards base, but



not reaching it, followed by a narrow buff shade divided by a slate-colour line; postmedial fine, dark brown, lunular, outcurved beyond cell, and terminating at dark space below vein 3; outer space narrowly fuscous brown, outwardly expanding between veins 3 and 5, and outbent on vein 6, above which there is only a dull greyish shade to apex, cut by a buff line; a narrow bright brown shade and a dentate black line follows the dark shade, though partly obsolete; termen dull dark slate from tornus to vein 3, above vein 5 mottled with buff. Hind wings: base narrowly whitish buff; medial space mottled brown and dark slate, narrow on costa, wide on inner margin, containing some irregular black lines and a broad black streak on discocellular, its outer edge straight from costa to vein 5, then outcurved, followed by a lilacine-buff shade crossed by a slate-grey line; postmedial space broadly brown, outwardly crossed by a faint buff line, and limited by an indistinct blackish line; termen dark slate between veins 3 and 4 and from 5 to apex, otherwise paler slate mottled with buff. Wings below thickly striated with dull brown; discal spots whitish edged with fuscous.

Expanse 27 mm.

*Hab.* Guapiles, Sixola, Esperanza.

Near *M. hermelina*, Gn. = *diversa*, Wlk., but differs in postmedial line on fore wing, and different hind wing.

*Mulelocha subnigra*, sp. n.

♂. Palpi fuscous, the third joint tipped with white, and with white ring at base. Head, collar, and thorax fuscous brown mottled with dark grey. Abdomen fuscous brown. Fore wings brownish slate-colour; base of costa and inner margin fuscous brown edged with dull grey; a fine dark brown curved antemedial line, expanding on costa, where it is preceded and followed by a whitish point; a medial fuscous-brown shade, faintly geminate and suffusing from vein 3 to inner margin with the postmedial line, which is slightly outcurved beyond cell, irregular, outwardly finely edged with dull grey, and on costa with whitish; reniform large, outlined in dull grey, and enclosing a whitish curved line on discocellular; the antemedial space on inner margin to fold shaded with pale reddish brown; an irregular and broken subterminal line, buff-grey; a faintly darker terminal lunular line marked by dark points on interspaces. Hind wings: base brownish irrorated with fuscous brown and crossed by a dark antemedial line; a broad fuscous-brown

medial shade followed by a slate-grey shade crossed by a slightly darker line, its outer edge diverging before anal angle and followed by fuscous brown, broadly between veins 3 and 6; this last shade outwardly partly edged with buff, and with two faint brownish shades outbent to termen; the terminal line more heavily marked than on fore wing. Wings below brownish black; fore wings with a white lunule on discocellular, a faint postmedial line marked with whitish on costa, and some marginal whitish spots from vein 5 to apex.

Expanse 27 mm.

*Hab.* La Florida, Esperanza.

*Mulelocha homopteridia*, sp. n.

♂. Palpi: second joint outwardly fuscous, inwardly orange-brown; third joint buff mottled with fuscous. Head, collar, and thorax fuscous brown irrorated somewhat with dull lilacine grey, the collar showing transverse darker shades. Abdomen dull fuscous grey, brighter mottled at base, and with a dorsal white point on second segment. Wings dull brown shaded with dull slate-colour; a terminal lunular black line. Fore wings: outer half of costa shaded with light brown; a similar shade below discocellular; lines velvety black; a basal line on costa; an indistinct wavy subbasal line; antemedial fine, inbent from costa where it is marked by a spot; a similar medial spot on costa, and a fine wavy medial line, geminate on inner margin; postmedial fine, outbent on costa, dentate beyond cell, inbent from vein 4, expanding on inner margin close to medial line, followed on costa by a buff spot; reniform semihyaline white, obliquely curved, and finely edged with darker brown; a subterminal dark brown shade between veins 6 and 8. Hind wings: a white spot on discocellular; a fine medial line, partly geminate; a broad postmedial line; a subterminal irregular fuscous shade, surmounted by lighter brown towards inner margin. Wings below fuscous; the light brown spaces of upper side replaced by yellowish-buff shades crossed by dark striæ; these extend on fore wing to base of costa, and below cell to base. Fore wings: a fine subterminal buff shade; terminal white striæ at vein 5. Hind wings with scattered white striæ.

Expanse 33 mm.

*Hab.* Juan Vinas.

*Orsa flava*, sp. n.

♂. Palpi dark grey. Head and collar grey; white spots on frons. Thorax yellow, shaded with grey in front. Abdomen yellow; a roseate line on basal segment, the terminal segments shaded with roseate. Wings bright yellow. Fore wings: the costa and outer margin broadly lilacine grey, the costa finely irrorated with black; some roseate scales at base below cell; a subbasal crimson spot on inner margin; antemedial fine, black on costa and cell, roseate from cell to submedian; orbicular a small dark point; medial and postmedial fine, curved on costa, black, from cell and vein 3 to inner margin inbent, roseate, the latter crossing below costa a reddish-brown shade which fills in the angle formed by the subterminal fuscous line, which is nearly straight and parallel with termen; a dark grey shade at apex. Hind wings: a medial dark roseate shade enclosing a white discal spot irrorated with black; a postmedial roseate line, finely streaked with dark grey except near costa; an irregular punctiform and geminate subterminal line; apex shaded with dark red; a terminal black line. Underneath similar, but duller, the lines fuscous.

Expanse 29 mm.

*Hab.* Sixola, Guapiles.

*Isogona capitalis*, sp. n.

♂. Palpi, head, and collar bright reddish brown. Thorax, abdomen, and wings fuscous slate-colour; anal hairs and lines buff-brown. Fore wings: antemedial line slightly outbent; a line from apex to beyond middle of inner margin, joined between veins 6 and 7 by an oblique, slightly down-curved line from costa above discocellular; spots small, hardly perceptible; a marginal line from apex to termen at vein 3, sharply inangled and then straight to tornus. Hind wings: a postmedial straight line.

Expanse 30 mm.

*Hab.* Avangarez, Sixola.

The specimen from Sixola differs in having the lines geminate.

*Capnodes hersilea*, sp. n.

♂. Palpi: second joint brown; third joint buff-brown. Head and collar brown, thorax and abdomen dull darker brown. Wings dull dark brown; a terminal darker line inwardly defined by a fine buff-brown edging. Fore wings:

lines buff, the antemedial slightly inbent; the postmedial angled below vein 7, followed by a diffuse buff shade extending from vein 6 to apex, below vein 6 shaded with dull brown limited by the subterminal buff line which is out-angled between veins 3 and 4; orbicular and reniform large, outlined in buff. Hind wings: postmedial line straight to inner margin near anal angle; subterminal line dentate, indistinct towards costa, close to postmedial near inner margin. Wings below buff, shaded with fuscous; discal spots; hind wings with distinct postmedial fuscous line and subterminal fuscous shadings, the intermediate space brighter.

Expanse 26 mm.

*Hab.* Juan Vinas.

*Capnodes lycoris*, sp. n.

♀. Head, collar, and thorax dark brown. Abdomen above fuscous. Fore wings dark reddish brown, glossed with lilacine blue except on costa, apex, and termen; antemedial and postmedial lines slightly outcurved, whitish buff, edged with reddish brown; subterminal dark brown spots outwardly shaded with lilacine blue, the terminal dark line inwardly so shaded. Hind wing dark reddish brown; some lilacine irrorations on outer half; a darker spot on discocellular; postmedial line pale reddish brown, darker edged; subterminal spots and terminal line as on fore wing. Wings below dull dark brown with a few greyish irrorations; darker discal points; postmedial line fuscous brown, outwardly edged with white on costa of fore wing; pale terminal points at veins.

Expanse 34 mm.

*Hab.* Guapiles.

*Capnodes hembrilla*, sp. n.

♀. Very close to *C. pueritia*, Cr.; inner side of palpi grey, not white. Collar brown instead of fuscous grey; dark spot at tornus of fore wing more remote from termen, and not so round; colour of wings brown without the roseate tinge. Wings below darker, thickly irrorated with dark brown; a broad subterminal fuscous-brown shade; postmedial line broader, cut on hind wings by yellowish veins.

Expanse 38 mm.; *C. pueritia* ♀ 30 mm.

*Hab.* Juan Vinas.



*Capnodes melie*, sp. n.

♂. Body above and wings purplish brown, the lines dull reddish brown. Fore wings: large dark brown costal spots at origin of lines, followed and preceded by pale brown shading on extreme costa; basal spot without a line; antemedial line incurved in cell, outcurved below cell and below submedian; a very faint medial darker shade; reniform reddish brown edged with black; postmedial line slightly outcurved, lunular; a very faint subterminal irregular darker shade; a terminal dark brown line, interrupted by light brown points at veins. Hind wings: a medial fuscous shade not reaching costal margin; a postmedial lunular line from vein 6 to inner margin; terminal line as on fore wing. Fore wing below fuscous grey, the costa broadly tinged with light brown; medial and postmedial outcurved fuscous lines on costal half of wing. Hind wing below light brown, shaded with fuscous grey on outer half; a black discal spot; a fuscous medial and postmedial line and faint subterminal shade.

Expanse 20 mm.

*Hab.* Sixola.

Near *C. pira*, Dr.

*Antarchaea poaphiloides*, sp. n.

♂. Palpi brown. Head grey-brown. Collar and thorax greyish buff. Abdomen buff. Fore wings creamy buff, the termen whiter; from inner margin beyond middle to termen just below apex a broad dark olive-grey stripe, faintly shaded about middle of wing with roseate brown, and inwardly edged from vein 3 to inner margin with black irrorations; a few scattered black scales; two fine pale reddish lines near dark stripe, barely traceable; terminal black points from above vein 2 to apex. Hind wings yellowish white, tinged with pale roseate brown terminally; black terminal points.

Expanse 22 mm.

*Hab.* Juan Vinas.

*Homopyralis aglaia*, sp. n.

♀. Palpi dark brown, the third joint buff at base and tips. Head, collar, and thorax mottled dark and pale brown. Abdomen dark greyish brown. Fore wings brown; some lilacine grey irrorations antemedially, at end of cell, postmedially beyond cell, and on fold, and also on termen; a

broad antemedial light brown shade edged with fuscous brown and divided by a fine dark line; a similar shade from costa across end of cell to inner margin, expanding outwardly beyond cell; subterminal consisting of an irregular dull mauve-grey line inwardly shaded with fuscous brown; a terminal wavy fuscous line. Hind wings fuscous brown. Wings below dull fuscous brown; hind wings with a darker curved medial shade and a subterminal shade.

Expanse 20 mm.

*Hab.* Carillo.

*Homopyralis albifasciata*, sp. n.

Head dark brown mottled with fuscous. Collar, thorax, and basal half of abdomen whitish mottled with brown; terminal segments darker. Fore wings: base from costa to submedian fuscous brown, edged with black, and crossed on costa by two fine roseate-brown lines; base of inner margin and antemedial space broadly white, crossed by the fuscous-brown antemedial line, which is outangled on costa, incurved across cell, outcurved below it, and again below submedian, followed in cell by a fine transverse fuscous line; the white space is followed by a narrow fuscous-brown medial fascia edged with black, but interrupted by white on median vein; outer portion of wing lilacine brown; reniform indicated by a dark line parallel with black outer edge of brown medial fascia; postmedial line whitish edged with dark brown, oblique and dentate on costa, vertical and zigzag opposite cell, incut along vein 3 and suffusing with medial fascia; traces of a whitish subterminal shade; whitish points terminally at veins; cilia fuscous. Hind wings dark brown; a terminal white line at anal angle. Hind wings below whitish irrorated with grey-brown; a dark medial and postmedial line; termen dark shaded.

Expanse 27 mm.

*Hab.* Avangarez.

*Homopyralis ardesiaca*, sp. n.

♂. Palpi whitish grey with transverse darker shades. Head, collar, thorax, and fore wings slate-grey. Abdomen dorsally with large lilacine-brown tufts on basal half, terminally dark grey irrorated with fuscous. Fore wings: a subbasal brown fascia, becoming fuscous on inner margin, shaded on either side with green; a faint brownish medial shade, indistinctly geminate; a dark brown spot on discocellular; a fine dark brown postmedial line, slightly

outcurved beyond cell, and narrowly edged outwardly with green, followed by a broad dull brownish shade; an indistinct brownish subterminal shade, chiefly opposite cell and between vein 2 and submedian; cilia mottled with paler grey. Hind wings dull brown, the termen slate-grey; a fuscous discal shade; a fine postmedial dark line, interrupted below vein 2, and partly edged with green. Wings below bluish white, irrorated with fuscous brown except on termen; a fuscous medial line, spots on discocellular, a fine interrupted postmedial line, and broad subterminal shade. Hind tibia fringed above with reddish-brown hairs.

Expanse 28 mm.

*Hab.* Cachi, Juan Vinas.

*Homopyralis charopus*, sp. n.

♂. Palpi fuscous; a buff shade at base of third joint. Head, collar, and thorax fuscous brown mottled with slate-colour. Abdomen above fuscous, underneath yellowish buff; a dorsal reddish shade on basal segment. Fore wings: costal margin and cell mostly fuscous brown, below cell from base to postmedial line lilacine brown, thinly irrorated with red; some pale brown spots on extreme costa at origin of lines; some whitish-grey tufts at base; subbasal forming a broad black shade; antemedial fine, lunular, black, followed by small black orbicular and by a similar medial line; reniform round, black; postmedial fine, black, somewhat punctiform where outcurved beyond cell, vertical from vein 3 to inner margin, and followed at vein 8 by a small cluster of reddish-brown scales; terminal space dull greyish brown faintly tinged with lilacine, the subterminal line slightly paler, irregular, and preceded by a broad fuscous-brown shade; large terminal fuscous spots between veins. Hind wings fuscous brown; a fine black streak on discocellular; terminal lunate black spots; a geminate black line at anal angle, separated by a whitish line. Wings below brownish grey; fore wings with faint traces of lines and small discal spot; hind wings with medial, postmedial, and subterminal darker shades.

Expanse 21 mm.

*Hab.* Esperanza.

*Homopyralis croceipalpis*, sp. n.

♂. Palpi yellow; second joint streaked with fuscous in front and tipped with fuscous; third joint with a fuscous

ring near tip. Head, collar, and thorax fuscous, the collar faintly edged with silky buff scales. Abdomen dark grey, with some paler transverse shades. Fore wing bone-white, shaded with pale olive-brown medially; base, costal margin, cell, and inner margin to beyond middle irrorated with fuscous brown, leaving a whitish antemedial line; a broad black line on discocellular; a postmedial fuscous-brown line from costa to vein 5; outer margin broadly fuscous brown, interrupted by an oblique white line from vein 5, bifurcating at apex; some whitish marginal shadings above tornus. Hind wings fuscous brown; traces of a postmedial buff shade, surmounted by a small black spot on inner margin. Wings below dull fuscous brown; darker discal spots; a broad pale postmedial shade; a dark medial line on hind wings.

Expanse 19 mm.

*Hab.* Sixola.

*Homopyralis elongata*, sp. n.

♂. Palpi fuscous grey, the basal half of third joint buff-white. Head, collar, and thorax dark greyish brown. Abdomen grey-black; a buff-white dorsal spot at base. Fore wings rather long and narrow, dull dark brown, indistinctly mottled with grey-buff, forming subbasal and antemedial lines, the latter followed by a fine irregular black line, and the space between them shaded with black; a small fuscous spot in cell and indistinct darker geminate medial line; a round black spot on discocellular; postmedial consisting of vague fuscous spots on veins, outcurved beyond cell, followed by a pale shade on costa and marked by a larger spot on submedian; the subterminal sinuous, greyish, outwardly edged with fuscous shades, chiefly above and below vein 5; terminal black spots; cilia black, cut by pale shades at veins. Hind wings dark brown; a short, white, black-edged streak at anal angle. Wings below greyish, the hind wings with indistinct discal spot, outer and subterminal lines.

Expanse 23 mm.

*Hab.* Sixola; also the Guianas.

The narrow wings and pale dorsal patch on abdomen will help to distinguish this species.

*Homopyralis nireus*, sp. n.

♂. Palpi buff, ringed with fuscous brown. Head reddish brown. Collar buff, irrorated with olive-brown. Thorax mottled reddish brown, buff, and black. Abdomen above



fuscous, irrorated with reddish brown. Fore wings reddish brown; base, a broad medial space, narrowing on inner margin, a postmedial patch below costa, and termen from below vein 5 to tornus heavily shaded with fuscous, mottled slightly with brown; antemedial space crossed by a fine dark reddish-brown line; a small pale shade beyond discocellular; traces of a dentate postmedial line, not apparent below vein 3; a fuscous subterminal shade, suffusing with terminal shades below vein 5; marginal black points connected by a fine lunular line. Hind wings: base and inner margin to tornus fuscous, with geminate black lines at end of cell; outer space reddish brown; a postmedial geminate shade to anal angle, fuscous towards costa, dark reddish brown towards angle; an irregular subterminal fuscous shade; termen irrorated with fuscous, the spots and line as on fore wing. Wings below buff, irrorated and shaded with fuscous brown; a dark medial and postmedial line; a broad subterminal and marginal shade, dark discal spots; some pale spots on costa of fore wing.

Expanse 34 mm.

*Hab.* Esperanza.

Near *H. ypsilon*, Btl.

*Homopyralis viridis*, sp. n.

♂. Palpi buff-brown, with numerous dark brown rings. Head and base of abdomen greyish buff, irrorated with reddish brown. Collar and thorax dull reddish brown, the broad scales tipped with whitish grey; abdomen except basal segment fuscous, dorsally and terminally mottled with buff and brown. Fore wings green to postmedial line; some scattered black scales on inner margin and below discocellular; costa shaded with dark brown; traces of a fine antemedial fuscous line and a wavy geminate medial line; a velvety black streak on discocellular; postmedial line fine, fuscous, outwardly edged with pale green and a dull brownish shade, outbent from costa, incurved opposite cell, dentate on veins 4, 3, and on submedian; terminal space purple-brown, with a faintly browner subterminal shade; marginal black spots outwardly shaded with pale green and connected by a lunular black line; cilia partly shaded with green. Hind wings purple-brown; the inner margin green; a green postmedial space not reaching costal margin; a black spot on discocellular; the lines interrupted, broader and more conspicuous between veins 5 and 6; terminal spots as on fore wings. Fore wings below grey-brown, the costa shaded

with red and black; cilia dull green, tipped with reddish. Hind wings below whitish, shaded with roseate brown; a thick brown discal streak, postmedial line, and subterminal shade.

Expanse 20 mm.

*Hab.* Avangarez; also from French Guiana.

*Homopyralis? diffusa*, sp. n.

♂. Palpi and body fuscous brown, the thorax mottled with dull lilacine. Fore wings dull lilacine slate, the markings fuscous brown; a small annular spot at base below cell, followed by a broad fascia, and then a fine reddish-brown antemedial line; orbicular small, round; a geminate medial line, inset on costa, suffusing with reniform, slightly irrorated with reddish scales; postmedial fine, macular from an inset spot on costa, faintly sinuous, and close to outer medial line from vein 3 to inner margin, followed between veins 7 and 8 by a spot; subterminal fine, inangled at veins 5 and 2, heavily dark shaded outwardly between 4 and 6; marginal spots connected by a lunular line. Hind wings whitish, heavily shaded with dull brown, and with faint traces of four lines. Wings below whitish, heavily shaded with dull brown; large fuscous discal spots: fore wings with antemedial and postmedial lines and geminate subterminal fainter shades; hind wings with medial and three punctiform lines; marginal fuscous spots on both wings.

Expanse 33 mm.

*Hab.* Turrialba.

*Homopyralis? lotis*, sp. n.

♂. Palpi outwardly brown, inwardly buff. Head, collar, and thorax dark brown, mottled with buff. Abdomen fuscous; a tuft of light brown scales dorsally at base. Fore wings buff-brown, irrorated with dark brown, the lines black-brown; a basal and subbasal fuscous-brown shade on costa; antemedial partly interrupted, preceded by a small black spot in cell, and closely followed by the small white orbicular point; a pale line on discocellular; postmedial obliquely outcurved beyond cell, thickest on costa and fold, somewhat interrupted by veins; subterminal fine, sinuous, light brown, preceded by a fuscous shade from vein 5 to costa; a terminal lunular black line. Hind wings fuscous; cilia mottled buff and fuscous. Hind wings below buff, finely irrorated with fuscous brown; a spot at end of cell; an interrupted curved

postmedial line; a subterminal shade, less apparent before anal angle, where it extends to termen.

Expanse 19 mm.

*Hab.* Tuis.

*Corna pegasis*, sp. n.

♂. Palpi fuscous brown. Head and body dark brown; a dorsal tuft at base of abdomen and tips of patagia mottled with metallic blue and red scales. Fore wings dark brown; some white irrorations on costal margin and postmedial space; an inbent antemedial line formed by clusters of white irrorations; a white point as orbicular; a fine white line across costa and discocellular, inbent above median, forming a short hook, interrupted just below median and above submedian; a lighter brown sinuous subterminal shade; cilia fuscous brown, irrorated with white at base. Hind wings dark brown. Hind wings below buff-grey irrorated with brown; a fuscous discal point; a curved dark postmedial line and subterminal shade.

Expanse 31 mm.

*Hab.* Tuis, Sixola.

*Baniana? haga*, sp. n.

♂. Antennæ pectinated. Palpi, head, and collar light reddish brown. Thorax dark lilacine grey, shoulders fuscous. Abdomen pale fuscous grey. Fore wings dull grey, tinged with lilacine; a dark brown antemedial vertical fascia, narrowing on costa, outwardly edged by a buff line; a small dark brown spot in cell medially circled with buff; from middle of inner margin a buff line, slightly outbent, curved around discocellular, downbent to vein 4, and upturned to vein 8 before subterminal shade, outwardly broadly shaded with dark brown; subterminal brown shade slightly incurved below vein 4; termen paler grey; a terminal dark brown line. Hind wings brownish grey; a terminal dark brown line.

Expanse 21 mm.

*Hab.* Juan Vinas.

Near *B. gobar*, Dr.

*Elecussa displosa*, sp. n.

♀. Palpi grey, irrorated with brown. Head, collar, and thorax dark brown, irrorated with grey. Abdomen above

dark brown. Body underneath pale buff, irrorated with brown. Wings slate-brown; a fuscous dentate terminal line. Fore wings: base irrorated with grey, antemedial line fine, dark brown, outangled on subcostal, inangled in cell, sharply outcurved, then incurved, and again abruptly outcurved on inner margin; orbicular round, whitish; reniform large, dull brown, edged with whitish, forming an "8"; traces of a dark medial line, outbent on costa; postmedial barely curved on costa, nearly straight and slightly inbent, fine, dark brown, partly edged with reddish brown and inwardly with whitish, followed by a dark brown patch between fold and submedian; veins on outer space shaded with reddish brown; subterminal consisting of angled black spots, outwardly edged with whitish. Hind wings: a dark shade on discocellular; postmedial as on fore wings, barely curved, followed by some black spots near inner margin; subterminal spots larger than on fore wings. Fore wings below greyish buff, the inner margin broadly dull grey; orbicular small, black; a fuscous medial line; reniform small, fuscous; postmedial fine, fuscous, edged with grey; postmedial space tinged with reddish brown; subterminal spots greyish. Hind wings below greyish buff; postmedial and subterminal spots as on fore wings; a distinct medial line, followed by a fuscous line on discocellular.

Expanse 37 mm.

*Hab.* Juan Vinas.

*Anomis gentilis*, sp. n.

♀. Palpi, head, collar, and thorax purple-brown, mottled with buff scales. Fore wings red, irrorated with yellow, the costal margin and veins grey-brown, irrorated with whitish scales; antemedial line slightly outbent from subcostal, fine, dark brown, inwardly edged with grey; a white point as orbicular; a medial dark line from subcostal across discocellular, vertical to inner margin, and outwardly edged with grey; a wavy postmedial line, white on costa, then dark, outwardly edged with grey, and only reaching vein 3; a sinuous subterminal dark brown shade, outwardly edged with paler red and shaded with white on costa; cilia white, spotted with fuscous at veins. Hind wings fuscous brown; cilia similar, tipped with white.

Expanse 26 mm.

*Hab.* Esperanza.

There is a specimen of this species in the B. M. from the United States presented by Prof. C. Riley.



LXIII.—*Notes on Fossorial Hymenoptera*.—XI.

By ROWLAND E. TURNER, F.Z.S., F.E.S.

*On some new Australian and Austro-Malayan Thynnidæ.*

THE following species were received among others from Dr. R. Hamlyn-Harris, of the Brisbane Museum, Mr. W. W. Froggatt, and Mr. G. A. Waterhouse. The types of all are in the British Museum.

*Rhagigaster aruensis*, sp. n.

♀. Nigra, subnitida, punctata; antennis pedibusque fusco-ferrugineis; segmento mediano obliquo, subconcavo.

♂. Niger, albido-pilosus; pedibus fusco-ferrugineis, coxis nigris; alis fusco-hyalinis, purpureo tinctis.

Long., ♀ 8, ♂ 14 mm.

♀. Head moderately convex, subrectangular, slightly rounded at the posterior angles, distinctly longer than broad, finely and sparsely punctured, the front more closely and coarsely punctured and thinly clothed with short fulvous hairs, a short median sulcus on the front, a sulcus on each side converging very slightly posteriorly, reaching from the eye to the posterior margin of the head. Pronotum scarcely more than half as long as the head, broadly rounded anteriorly, narrower than the head, as broad posteriorly as long, the whole thorax very sparsely punctured. Median segment oblique from just behind the scutellum, subconcave. Abdomen more closely punctured, the first segment shorter than the second, vertically truncate at the base; second dorsal segment with a depressed transverse line at the base; sixth dorsal segment with a distinct pygidial area, almost pointed at the apex.

♂. Clypeus rather sparsely punctured, with a carina from the base not reaching the apex, which is feebly triangularly depressed in the middle, the apical margin truncate. Front rugose, vertex strongly punctured; the interantennal prominence broadly rounded at the apex, with marginal carinæ which join a transverse carina not quite extending to the eyes. Antennæ about as long as the thorax and median segment combined, not very stout, the apical joints very slightly arcuate beneath. Anterior margin of the pronotum straight and strongly raised. The whole thorax deeply and closely punctured; scutellum broadly rounded or subtruncate at the apex. Abdomen more shallowly punctured

than the thorax; sixth dorsal segment rugose, broadly rounded at the apex. Hypopygium forming a recurved apical spine, without lateral spines. First recurrent nervure received at two-thirds from the base of the second cubital cell, second at one-sixth from the base of the third cubital cell; third abscissa of the radius nearly half as long again as the second.

*Hab.* Aru (*Elyner*). Received from Mr. Froggatt.

This is the first species of the genus recorded from the Austro-Malayan region. It is nearest to *R. fulvipennis*, Turn., from Cape York, but differs both in sculpture and colour.

*Tachynomyia fervens*, Sm.

*Ælurus fervens*, Sm. Cat. Hym. B.M. vii. p. 58 (1859). ♂.

♀. Fusco-nigra; thorace, antennis pedibusque ferrugineis. Long. 11 mm.

♀. Head closely and finely punctured, more than half as broad again as long, slightly rounded at the posterior angles, with a short frontal sulcus. Pronotum very little more than half as broad as the head, nearly quadrate, shining and sparsely punctured; scutellum small and narrow; median segment twice as long as the scutellum, shining and sparsely punctured, strongly broadened posteriorly. Abdomen very finely punctured; first dorsal segment almost vertically truncate anteriorly, with a shallow transverse groove before the apex; second dorsal segment with a transverse carina at the base and another on the apical margin, the space between coarsely transversely rugulose. Pygidium simple, not truncate or compressed, longitudinally rugose, with a low median carina, rounded at the apex. All the ventral segments closely and rather strongly punctured.

*Hab.* Woodford, N.S.W. (*G. A. Waterhouse*); December.

This species ranges with little variation from Victoria to Brisbane. The female has not been previously described.

*Leiothynnus spinigerus*, sp. n.

♂. Niger, albo-pilosus, gracilis; clypeo margine apicali, orbitis interioribus, pronoto margine anteriore postscutelloque flavis; pedibus anticis et intermediis, tibiisque posticis subtus bruneo-testaceis; alis hyalinis, venis nigris, cellula radiali infuscata, femoribus intermediis basi dentatis.

♀. Bruneo-testacea; capite rufo-testaceo; thorace nigro; pedibus fuscis, tibiis bruneis, tarsis anticis intermediisque testaceis; segmento dorsali secundo transverse quadricarinato.

Long., ♂ 12, ♀ 7 mm.

♂. Clypeus convex, rather narrowly truncate at the apex. Antennæ shorter than the thorax and median segment combined, of almost even thickness throughout, the joints not arcuate beneath; interantennal prominence bilobed, not strongly developed. Apical joints of the maxillary palpi not elongate. Head, thorax, and abdomen finely and closely punctured; a ferruginous spot on each side of the vertex close to the summit of the eyes. Scutellum strongly convex. Abdomen slender, subpetiolate, the first segment fully twice as long as its apical breadth; seventh dorsal segment rugose; hypopygium small, about twice as long as the greatest breadth, the sides parallel, rounded at the apex, with a slender apical spine. Intermediate femora with a spine beneath at the base. Third abscissa of the radius half as long again as the second; second recurrent nervure received by the third cubital cell at one-fifth from the base.

♀. Clypeus convex, with a carina, truncate at the apex. Head nearly half as broad again anteriorly as the greatest length, strongly rounded posteriorly, smooth and shining, with a short frontal sulcus. Thorax much narrower than the head; pronotum subquadrate, punctured. First dorsal segment broadly depressed at the apex, with a rounded raised mark on each side before the apex; second segment with four transverse carinæ, including the raised apical margin; dorsal plate of the pygidium lanceolate, very narrow, ventral plate recurved at the sides and forming a groove for the dorsal plate, a tuft of pale hairs on each side near the apex of the dorsal plate. Fifth ventral segment sparsely but strongly punctured.

*Hab.* Stradbroke Island, Moreton Bay (*Hacker*); October.

Allied to *L. mackayensis*, Turn., from which the male may be easily distinguished by the spine at the base of the intermediate femora; and the female by the absence of a sulcus on the pronotum, and the shape of the head, which is more strongly narrowed posteriorly.

*Epactiothynnus nitidiceps*, sp. n.

♀. Brunco-testacea; capite nitido, antice dilatato; pronoto postice longitudinaliter carinato; segmento dorsali secundo transverse tricarinato.

♂. Niger; mandibulis basi, macula utrinque supra basin antenarum, pronoto antice et postice, mesonoto macula longitudinali, scutello macula parva mediana, postscutello, tegulis segmentisque dorsalibus 2-6 macula transversa utrinque pallide flavis; pedibus testaceis; alis hyalinis, venis fuscis, stigmatibus testaceo.

Long., ♀ 4, ♂ 7 mm.

♀. Head smooth and shining, broader anteriorly than long, very strongly narrowed posteriorly, only slightly convex; pronotum with a low carina on the posterior half, as long as broad, a little narrowed posteriorly; scutellum and median segment combined shorter than the pronotum; thorax and abdomen subopaque, almost smooth, the median segment shining. First dorsal segment rather broadly depressed at the apex; second dorsal segment with three strong transverse carinae, including the raised apical margin; pygidium very narrow, the sides parallel, narrowly truncate at the apex. Legs slender.

♂. Head and thorax very finely and closely punctured; clypeus rather narrowly truncate at the apex; antennae rather slender, a little longer than the thorax and median segment combined, of about even thickness throughout. Scutellum strongly convex, median segment shining and almost smooth. Abdominal segments rather strongly constricted at the base, subopaque and almost smooth. Hypopygium produced into a slender acute and somewhat recurved spine, with a small spine on each side at the base. Second abscissa of the radius a little longer than the third; second recurrent nervure received at one-sixth from the base of the third cubital cell.

*Hab.* Aru (*Elgner*).

I think that this is distinct from *lavissimus*, Sm., which is probably the female of *abductor* and is a much larger species. From *abductor* the male differs in the shape of the hypopygium, the colour of the legs, and the smaller size.

*Hemithynnus tillyardi*, sp. n.

♀. Nigra, sparsissime punctata; fronte supra antennas, macula pone oculos, angulis posterioribus capitis, vertice lineis duabus postice convergentibus, macula parva frontali, pronoto marginibus lateralibus, margine postico late interrupto, et macula parva mediali marginis antici, scutello postice, segmentis dorsalibus primo secundoque fascia transversa interrupta, tertio quartoque fascia late interrupta, quinto macula utrinque segmentisque ventralibus 2-4 macula laterali utrinque flavis; segmento dorsali secundo carinis transversis 8.

♂. Niger, albo-pilosus; mandibulis, clypeo apice lateribusque, vertice macula parva utrinque, pronoto linea arcuata interrupta, mesopleuris macula parva, segmentis dorsalibus 1-6 ventralibusque 2-5 macula laterali utrinque flavis; alis pallide flavo-hyalinis, venis fuscis.

Long., ♀ 18, ♂ 23 mm. .

♀. Clypeus with a carina not reaching the apex, which is



produced in the middle into a point. Head about half as broad again as long, rounded at the posterior angles, sparsely punctured, the punctures on the front larger and deeper than those on the vertex, a short frontal sulcus, the position of the posterior ocelli indicated by shallow depressions; eyes narrowly ovate, not reaching the base of the mandibles. Pronotum fully twice as broad as long, not narrowed posteriorly, the anterior margin straight, with a few setigerous punctures, the pronotum and scutellum sparsely and finely punctured, pleuræ smooth. Median segment steeply sloped from just behind the scutellum, very finely punctured, with a few larger punctures. Abdomen sparsely punctured; first dorsal segment with two transverse carinæ at the apex, with a broad groove between them; second segment with about eight strong but slightly irregular transverse carinæ; third segment distinctly transversely striated at the base. Pygidium almost vertical, a little more than twice as long as broad, with a strong spine on each side near the apex, the dorsal plate strongly longitudinally striated, a little shorter than the ventral plate and narrowly rounded at the apex, ventral plate broadly rounded. Fifth ventral segment longitudinally rugose.

♂. Clypeus convex, narrowed towards the apex, which is rather broadly truncate. Antennæ longer than the thorax and median segment combined, the apical joints rather slender and very feebly arcuate beneath. Head and thorax finely and very closely punctured, the anterior margin of the pronotum slightly raised. Abdomen fusiform, shining and almost smooth, the segments very slightly constricted at the base; apical dorsal segment punctured rugose. Hypopygium in the form of a slightly elongate triangle, with an acute apical spine, the basal angles prominent and rounded. Third abscissa of the radius a little longer than the second; first recurrent nervure received at two thirds from the base of the second cubital cell, second at one-third from the base of the third cubital cell.

*Hab.* Dorrigo, N.S.W. (*R. J. Tillyard*); November.

This belongs to the group of *rufiventris*, Guér.; the male is nearly allied to *kirbyi*, Turn., and *crinitus*, Turn., from both of which it differs in colour, from the former also in the somewhat greater breadth of the head and clypeus and the less elongate hypopygium, from the latter in the much stronger sculpture of the seventh dorsal segment and the much sparser and shorter pubescence of the thorax. The female differs from *kirbyi* in the larger head, the sculpture of the first three dorsal segments, and the greater length of

the pygidium; from *crinitus* in the much shorter dorsal surface of the median segment and in colour.

*Hemithynnus hamlyn-harrisi*, sp. n.

♂. Flavo-aurantiacus; vertice, mesonoto, mesosterno, scutello basi segmentisque abdominalibus 3-7 nigris; segmento mediano flavo; alis flavo-hyalinis, apice hyalinis.

♀. Ferruginea; fronto segmentisque abdominalibus 3-5 nigris; segmentis dorsalibus 1-5 macula laterali utrinque, primo fascia transversa lata, 2-5 fascia interrupta, segmentisque ventralibus 2-4 macula utrinque flavis; clypeo carinato, in spinam acutam producto.

Long., ♂ 22, ♀ 16 mm.

♂. Clypeus convex, broadly truncate at the apex; eyes divergent towards the clypeus. Antennæ about as long as the head, thorax, and median segment combined, the apical joints slender. Interantennal prominence strongly bilobed. Head and thorax opaque, closely and finely punctured; abdomen shining and sparsely punctured. Median segment steeply sloped from the postscutellum; pubescence grey on the head and median segment, fulvous on the thorax. Seventh dorsal segment striate, the striae curved at the apex; hypopygium triangular, with an acute apical spine, the basal angles not prominent.

♀. Clypeus with a strong median carina, produced at the apex into an acute spine; mandibles very stout, blunt at the apex. Eyes narrowly oval. Head convex, fully half as broad again as long, rounded at the posterior angles; head, thorax, and median segment shining, very sparsely punctured, with a few long scattered grey hairs. Pronotum twice as broad as long; scutellum not much narrowed, a little shorter than the median segment. First dorsal segment with a transverse groove just before the apex; second segment with about seven irregular transverse carinae which are low and curve towards the base on each side, the apical margin strongly raised. Segments 3-5 shining, almost smooth; pygidium vertically truncate posteriorly, the dorsal plate as long as the ventral, broadly ovate, closely longitudinally striated, with a long spine on each side near the apex, the apical margin smooth. Fifth ventral segment rugose-striate.

*Hab.* Brisbane (*Hacker*); September. Received from Dr. Hamlyn-Harris.

The male is the type.

Both sexes are very near the common *H. apterus*, Oliv., but the colour of the male is very distinct, the median

segment more abruptly truncate and the hypopygium rather more narrowly triangular. The female differs in the much greater development of the apical spine of the clypeus and in the distinctly broader pygidium.

I mentioned the male as a variety of *H. apterus* (Proc. Linn. Soc. N.S.W. xxxiii. p. 191, 1908), but this is a mistake, though the structural differences in both sexes are slight. *H. apterus* also occurs near Brisbane; it seems to show differences in the sculpture of the second abdominal segment of the female in different localities, and it is possible that more than one species may be confused under the name.

*Thynnoides mesopleuralis*, sp. n.

♀. Nigra; thorace segmentoque mediano rufo-ferrugineis; mandibulis basi fusco-ferrugineis; pedibus rufo-testaceis; antennis fuscis; segmento dorsali secundo carinis transversis sex; pygidio angusto, elongato; segmento ventrali quinto rugoso.

♂. Niger, albo-pilosus; mandibulis basi, clypeo margine apicali, maculaque utrinque supra basin antennarum pallide flavis; mesopleuris rufo-ferrugineis; tibiis femoribusque posticis subtus fusco-ferrugineis; alis hyalinis, venis nigris, stigmatibus testaceo.

Long., ♀ 8, ♂ 12 mm.

♀. Head distinctly broader than long, not narrowed anteriorly, rounded at the posterior angles, only slightly convex, shining, the front strongly but not closely punctured, the vertex almost smooth, the clypeus without a carina. Pronotum almost smooth, fully twice as broad as long, the anterior margin broadly arched; scutellum almost smooth; median segment closely punctured; the whole thorax short, very little longer than the head. First dorsal segment punctured, broadly depressed and smooth at the apex; second dorsal segment with five transverse carinae rather close together and broadly separated from the strongly raised apical margin; segments 3-5 shallowly and not very closely punctured; fifth ventral segment rugose; pygidium long and very narrow, constricted near the middle.

♂. Clypeus convex, very shallowly and widely emarginate at the apex, closely punctured. Antennae nearly as long as the thorax and median segment combined, very slightly narrowed to the apex, the joints not arcuate beneath; interantennal prominence bilobed. Head, thorax, and abdomen finely and closely punctured; scutellum strongly convex; angles of the pronotum not prominent; median segment rounded. Abdominal segments strongly constricted at the base; seventh dorsal segment almost smooth



at the base, sparsely punctured at the apex; hypopygium narrow, the sides curved upwards, without basal spines, the apical spine slender and slightly recurved. Anterior coxæ distinctly concave. Second abscissa of the radius as long as the third; second recurrent nervure received at one-sixth from the base of the third cubital cell.

*Hab.* Brisbane (*Hacker*); September.

In colour the male resembles *T. pugionatus*, Guér., which occurs in the same locality, but the colour of the legs is different. The female is quite distinct.

*Thynnoides berthoudi*, sp. n.

♂. Niger, albo-pilosus; mandibulis, clypeo, orbitis oculorum, margine postico capitis, lineisque duabus obliquis inter antennis flavis; alis fusco-hyalinis, basi subhyalinis, venis nigris.

Long. 16 mm.

♂. Clypeus convex, produced and not very broadly truncate at the apex; antennæ very slightly attenuated towards the apex, as long as the thorax and median segment combined; the interantennal prominence broadly rounded at the apex, marked in the middle with an obscure longitudinal carina. The whole insect opaque, closely and not coarsely punctured, more finely on the median segment than elsewhere, the whitish pubescence dense on the median segment and on the apical margins of the abdominal segments. Abdominal segments strongly constricted at the base; the basal segment as broad at the apex as long, with a broad longitudinal sulcus nearly reaching the apex. Apical dorsal segment longitudinally striated, truncate at the apex; hypopygium elongate-triangular, the basal angles prominent, the apical spine slightly recurved. Anterior coxæ slightly concave. Third abscissa of the radius half as long again as the second; first recurrent nervure received beyond two-thirds from the base of the second cubital cell, second a little before one-third from the base of the third cubital cell.

*Hab.* Waroona, Western Australia (*G. F. Berthoud*); December.

Nearest to *nephelopterus*, Turn., but differs in the much denser pubescence, the less concave fore coxæ, and the less prominent basal lobes of the hypopygium. The yellow markings on the head are also different.

*Thynnoides fuscocostalis*, sp. n.

♂. Niger; mandibulis basi clypeoque margine apicali pallide flavis; alis subhyalinis, costa obscuriore, venis nigris.



♀. Nigra, nitida, sparsissime punctata; segmento dorsali secundo carinis 5 transversis; area pygidiali angusta; segmento ventrali quinto rugoso.

Long., ♂ 17, ♀ 11 mm.

♂. Clypeus closely punctured, widely and rather shallowly emarginate at the apex. Head, thorax, and abdomen closely but not coarsely punctured, with sparse white pubescence. Antennæ short, scarcely as long as the thorax and median segment combined, slightly narrowed to the apex; the interantennal prominence broadly rounded at the apex. Anterior angles of the pronotum not produced; scutellum separated by a fovea from the mesonotum, with a low carina from the base to the apex; median segment rounded. Abdominal segments constricted at the base; the first segment broader at the apex than long and marked with a longitudinal sulcus from the base to beyond the middle. Sixth dorsal segment very coarsely punctured, rounded at the apex; hypopygium transversely striated above, elongate-triangular, with an acute apical spine, the basal angles strongly produced into blunt teeth. Third abscissa of the radius longer than the second; first recurrent nervure received beyond the middle of the second cubital cell, second at two-sevenths from the base of the third cubital cell. Anterior coxæ very slightly concave; the spur of the anterior tibiæ testaceous.

♀. Head moderately convex, shining and sparsely punctured, with a short shallow frontal sulcus, nearly half as broad again as long, slightly narrowed anteriorly and strongly rounded at the posterior angles; the clypeus without a carina, the anterior margin straight. Pronotum distinctly broader than long, the anterior margin slightly arched, finely and sparsely punctured, with a few deep setigerous punctures along the anterior margin. Scutellum and median segment rather more strongly punctured, the median segment scarcely longer than the scutellum, broadened and very steeply sloped posteriorly. Abdomen shining, sparsely punctured; first dorsal segment with a wide groove between two transverse carinæ at the apex; second segment with five strong transverse carinæ, including the raised apical margin; fifth ventral segment coarsely rugose. Pygidium narrowed at the base, fully three times as long as the greatest breadth, the dorsal plate shorter and narrower than the ventral, marked with an obscure longitudinal carina, the ventral plate rounded at the apex, a tuft of pale fulvous hairs on each side before the apex.

*Hab.* Brisbane (*H. Hacker*) ; September.

Very near *waterhousei*, Turn., from which it differs in the shape of the head in the female and in the shape and colour of the anterior margin of the clypeus in the male.

*Lestricothynnus optimus*, Sm.

*Thynnus optimus*, Sm. Cat. Hym. B.M. vii. p. 29 (1859). ♂.

*Thynnus sulcatus*, Sm. Cat. Hym. B.M. vii. p. 42 (1859). ♀.

*Hab.* Dorre Island, W. Australia (*Grant Watson*). ♂ ♀  
*in cop.*

I had previously suggested that these were sexes of one species, and a considerable series of both sexes, many taken *in copulâ*, in Grant Watson's collection confirms my conjecture. Several of these pairs are now in the National Collection.

*Leptothynnus* (?) *peltastes*, sp. n.

♂. Niger, albido-pilosus ; alis subhyalinis, venis nigris ; segmento ventrali sexto utrinque spina acuta armato ; segmento dorsali septimo lamella plana haud instructo ; hypopygio linguiforme, apice spina acuta armato, spinis basalibus nullis.

♀. Nigra, nitida, sparse punctata ; segmento dorsali primo transversa rugoso, apice late sulcato ; segmento dorsali secundo transverse quinquecarinato ; epipygio triangulari, obliquo, basi angusto ; hypopygio apice late rotundato, epipygio multo longiore ; segmento ventrali quinto rugoso.

Long., ♂ 17, ♀ 14 mm.

♂. Clypeus moderately convex, closely punctured, broadly truncate at the apex, the labrum slightly exposed and broadly rounded at the apex. Head closely and finely punctured, the interantennal carina almost transverse ; antennæ longer than the thorax and median segment combined, distinctly slenderer at the apex, the apical joints very feebly arcuate beneath. Anterior margin of the pronotum distinctly raised, the angles not prominent. Thorax closely punctured ; median segment much more finely punctured, rounded ; scutellum flattened ; anterior coxæ flattened. Abdomen rather slender, fusiform, shallowly and rather sparsely punctured, the segments scarcely constricted at the base ; sixth ventral segment with a spine on each side at the apical angles ; seventh dorsal segment not produced into a flattened plate ; hypopygium linguiform, with an acute apical spine. Second abscissa of the radius as long as the third ; second recurrent nervure received just beyond one-third from the base of the third cubital cell.

♀. Mandibles rather long, acute at the apex; clypeus transverse, without a carina. Head strongly but not very closely punctured, much broader than the thorax, nearly twice as broad as long, rounded at the posterior angles. Pronotum fully twice as broad as long, the sides parallel, finely and closely punctured; scutellum more strongly and sparsely punctured, much narrower than the pronotum; median segment no longer than the scutellum, finely and not very closely punctured. First dorsal segment transversely rugose, with a deep transverse groove between the carinae at the apex; second dorsal segment with five strong transverse carinae, including the raised apical margin; segments 3-5 shining and sparsely punctured; fifth ventral segment coarsely rugose. Pygidium oblique, the dorsal plate triangular, narrow at the base, the surface rugose; the ventral plate much longer than the dorsal and very broadly rounded at the apex. Tarsi normal.

*Hab.* Dorrigo, New South Wales (R. J. Tillyard); November.

This species can only be placed provisionally in *Leptothynnus*, the male having no flattened plate on the seventh dorsal segment and the pygidium of the female being narrowed at the base.

*Zaspilothynnus hackeri*, sp. n.

♂. Niger, albo-pilosus; segmentis abdominalibus sexto septimoque rufis; alis subhyalinis.

♀. Nigra, nitida, sparse punctata; segmento dorsali secundo carinis septem transversis; segmento ventrali quinto longitudinaliter striato; pygidio ovato, longitudinaliter striato, basi haud constricto.

Long., ♂ 20, ♀ 15 mm.

♂. Clypeus closely punctured, convex, broadly and shallowly emarginate at the apex, the angles of the emargination produced into short spines. Head, thorax, and abdomen closely punctured; antennae shorter than the thorax and median segment combined, slightly narrowed to the apex, the apical joints very feebly arcuate beneath. Inter-antennal carina almost transverse, a low frontal carina almost reaching the anterior ocellus. Anterior margin of the pronotum transverse, the angles not prominent. Dorsal surface of the median segment as long as the scutellum, the posterior slope steep. Abdomen elongate; the segments moderately constricted at the base; sixth ventral segment with a very short blunt spine on each side at the apical

angles; seventh dorsal segment longitudinally rugose, produced into a very short flattened plate rounded at the apex, with several curved striæ below the apex of the dorsal plate and above the hypopygium, which is triangular, with a short blunt apical spine, and produced strongly at the basal angles into blunt lobes. Anterior coxæ slightly concave. Third abscissa of the radius longer than the second; second recurrent nervure received at one-quarter from the base of the third cubital cell.

♀. Clypeus transverse, without a carina; head small, broader than long, slightly narrowed anteriorly, strongly rounded at the posterior angles, shining and almost smooth, coarsely punctured in the middle of the front. Pronotum finely and closely punctured, half as broad again as long, with a few deep setigerous punctures along the anterior margin. Scutellum and median segment sparsely punctured, about equal in length. Abdomen shining, very sparsely punctured, the first dorsal segment with a narrow transverse groove before the strongly raised apical margin; second segment with seven well-defined transverse carinæ, including the strongly raised apical margin; fifth ventral segment longitudinally rugose-striate; pygidium vertically truncate, ovate, with about five arched carinæ on the basal half, the apical half almost smooth, broadly rounded at the apex, not constricted at the base, the ventral plate longer than the dorsal. Intermediate tibiæ moderately stout, basal joint of intermediate tarsi slightly broadened.

*Hab.* Brisbane (*H. Hacker*); September.

The male is easily distinguished by the emarginate clypeus, the very short spines of the sixth ventral segment, and the colour, the latter character resembling that of the West-Australian species *Z. crudelis*, Turn., and *Z. trilobatus*, Turn., both of which are much smaller. It bears a strong superficial resemblance to *Dimorphothynnus hæmorrhoidalis*, Guér. The female differs from most species of the genus in the absence of constriction at the base of the pygidium, in this character resembling *Z. dilatatus*, Sm.

### *Thynnus mutundus*, sp. n.

♂. Niger; clypeo, mandibulis, marginibus oculorum, maculis duabus supra antennis, vertice linea transversa utrinque, pronoto marginibus, tegulis, pleuris, mesonoto linea longitudinali discoidali utrinque, scutello linea curvata interrupta, postscutello, segmento mediano linea nigra longitudinali utrinque, segmentis dorsalibus 1-6 fascia lata transversa utrinque, segmentis ventralibus 1-6



fere totis, coxisque flavis: pedibus pallide ferrugineis flavo-variegatis; alis hyalinis, flavo tinctis, venis fuscis.

♀. Nigra; scutello tibiisque extus flavo-testaceis; segmentis dorsalibus primo tertioque fascia lata transversa, quarto, quinto sextoque macula obscura laterali utrinque flavo-ochraceis; segmento dorsali secundo carinis 9 transversis.

Long., ♂ 17, ♀ 10 mm.

♂. Clypeus convex, sparsely punctured, broadly truncate at the apex, the angles not produced, almost pointed at the base. Interantennal prominence well developed, connected with the base of the clypeus by a short narrow carina, divided by a longitudinal sulcus which almost reaches the anterior ocellus. Eyes slightly divergent towards the clypeus, the posterior ocelli as far from each other as from the eyes, the anterior ocellus situated in a depression. Antennæ about as long as the thorax and median segment combined, the joints not arcuate beneath, the apical joints not quite so stout as the basal. Head closely but not coarsely punctured, thorax and abdomen more sparsely punctured, subopaque; mesopleuræ very closely and finely punctured. Scutellum ending in a blunt point; post-scutellum depressed below the scutellum, the apex subacute and produced beyond the base of the vertical truncation of the median segment. First abdominal segment as broad as the second, vertically truncate anteriorly; sixth ventral segment with an acute spine on each side at the apical angles. Seventh dorsal segment produced into a flat process, longitudinally striated. Hypopygium obliquely striated above, as broad at the base as long, with a strong spine on each side near the base, narrowed towards the apex and rather broadly truncate at the base of the stout apical spine. Third abscissa of the radius longer than the second, first recurrent nervure received at three-quarters from the base of the second cubital cell, second just beyond one-quarter from the base of the third cubital cell.

♀. Head rather small, no broader than the pronotum; mandibles falcate, acute at the apex; clypeus without a carina, punctured. Front with a deep excavation on each side, smooth and shining; the excavations elongate and nearly reaching the eyes, separated by a rather narrow elevated space the lateral margins of which are raised into carinæ, the space between the carinæ punctured, with an obscure median carina and a few long cinereous hairs. Vertex smooth and shining, the posterior margin of the head widely emarginate. Pronotum coarsely and shallowly punctured, with a low median carina from the base to the apex,

the anterior margin raised and widely emarginate, nearly half as wide again as the posterior and lateral margins. Scutellum short and transverse, almost smooth, much narrower than the pronotum. Median segment shining and almost smooth, broadened posteriorly, the dorsal surface only about one-third of the length of the pronotum, obliquely truncate posteriorly, the surface of the truncation raised along the median line. Abdomen shining and sparsely punctured, much broader than the thorax, the basal segment with a patch of long cinereous hairs in the middle; second segment with nine strong transverse carinæ, higher at the apex than at the base; pygidium narrow and transversely striated at the base, sharply narrowed before the base of the almost vertical posterior truncation, the surface of which is twice as long as broad, smooth, the dorsal plate much shorter than the ventral, with a notch on each side at the base, the ventral plate emarginate at the apex and serrate at the sides. Fifth ventral segment longitudinally striated. Intermediate tibiæ broad and strongly spinose.

*Hab.* Aru (*Elgner*). Sent by Mr. Froggatt.

This belongs to the group of *T. serriger*. Sharp, and is nearest to *T. celebensis*, Turn., from which the male differs in the sparser puncturation, in which it approaches more closely to *T. olivaceus*, Turn. From both of these species it differs in the truncation of the hypopygium. The female differs from *calvus*, Turn., in the narrower pygidium, the narrower raised median space on the front, and in the shape of the scape, which is curved, not elbowed as in *calvus*; the sculpture is also different. The raised frontal area is also narrower than in *celebensis*, Turn., and with a less strongly marked median carina.

LXIV.—*Brief Diagnoses of Eight new Petalia, with a List of the known forms of the Genus.* By KNUD ANDERSEN.

*Petalia tragata*, sp. n.

As *P. javanica* ( $p_4$  large), but free portion of tragus linguulate ("tongue-shaped"), *i. e.* inner as well as outer margin passing in a smoothly rounded curve into upper margin (in *P. javanica* corresponding portion of tragus semilunate, *i. e.* inner margin joining upper in a sharp angle); skull a little heavier, premolars and molars conspicuously larger. Skull

of type (an *immature*, though probably nearly full-grown, specimen), condylo-canine length 19.2 mm., against 17.8–19 in twenty-three fully adult skulls of *javanica*, c-m<sup>3</sup> (crowns) 8.2, against 7.2–7.8 in twenty-six adult *javanica*; external dimensions probably very nearly as in *P. javanica*.

*Type*, ♀ imm. (alc.), Bidi Caves, Sarawak, presented by Cecil J. Brooks, Esq., B.M. 3. 3. 31. 1. The range of this form extends to the Malay Peninsula (♀ juv., Biserat, B.M. 3. 2. 6. 85).

*Petalia nana*, sp. n.

Allied to *P. arge* (p<sub>4</sub> large), but considerably smaller, and with proportionately much smaller ears (tragus not differing in shape, being lingulate as in *arge*). Forearm of type 34 mm. (39.5–45 in ten adult *arge*), third metacarpal 25.7 (30.5–34.2), tibia 14.5 (20–23.7), ear from base of inner margin 15.5 (23–26.5), maxillary tooth-row (c-m<sup>3</sup>, crowns) 5.7 (6.8–7.3).

*Type*, ♂ ad. (alc.), Benito R., French Congo, collected by Mr. G. L. Bates, B.M. 0. 2. 5. 46.

This is the smallest known form of the genus.

*Petalia major*, sp. n.

Similar to *P. arge* (p<sub>4</sub> large, tragus lingulate), but easily distinguished by its conspicuously larger size, being about equal in dimensions to *P. ethiopica luteola*. Forearm of type 49 mm. (39.5–45 in ten adult *arge*); skull, total length 22.2 (19.5–20.2), condyle to front of canine 19.7 (16.8–17.7), maxillary tooth-row 7.8 (6.8–7.3).

*Type*, ♀ ad. (alc.), Ja R., Cameroons, 23 Jan., 1906, collected by Mr. G. L. Bates, B.M. 9. 10. 2. 49.

*Petalia aurita*, sp. n.

Dentition (incisors and p<sub>4</sub>), tragus, and external dimensions as in *P. hispida*, but ears much longer, skull larger, tooth-rows longer. Forearm of type 43 mm. (in forty-seven adult *P. hispida* 37.2–43), ear from base of inner margin 21.5 (16.5–18.7); skull, total length 18.7 (in thirty-two adult *hispida* 16.5–17.8), condyle to front of canine 16.1 (14–15.3), c-m<sup>3</sup> (crowns) 6.5 (5.5–6.1).

*Type*, ♀ ad. (alc.), Kiliŋi, British East Africa, collected and presented by G. D. Trevor-Roper, Esq., B.M. 89. 1. 11. 1. Other specimens from Maungu, B.E.A., and Burao, Somaliland.

*Petalia thebaica adana*, subsp. n.

As *P. th. thebaica* (Egypt), but teeth larger, colour of fur paler. c-m<sup>3</sup> (crowns) in nine skulls (type and topotypes) 6·8–7·1 mm., as against 6·5–6·8 in four skulls from Egypt; forearm (type and twenty topotypes) 42·5–46·5 (nine *th. thebaica*, 41–45). Colour of fur of upperside pale drab, in *th. thebaica* drab-slate.

*Type*, ♀ ad. (skin), Myba, nr. Aden, 17 Aug., 1899, collected by Mr. W. Dodson, B.M. 99. 11. 6. 18.

*Petalia damarensis brockmani*, subsp. n.

Probably the north-eastern representative of *P. d. damarensis*, from which it is distinguishable only by the larger average size of the skull. Total length of skull (fourteen specimens) 21–21·5 mm. (20–21·2 in six *d. damarensis*), total length of lower jaw 13·7–14·2 (12·7–13·7), maxillary tooth-row (crowns) 7·2–7·7 (7–7·5). Forearm 47–51, ear from base of inner margin 29–31·5 mm.

*Type*, ♀ ad. (skin), Upper Sheikh, British Somaliland, 4300', 11 Jan., 1910, collected and presented by Dr. R. E. Drake-Brockman, B.M. 10. 3. 27. 4. The range of this form is known to extend to Erythrea. *P. d. damarensis* occurs in Damaraland and Namaqualand, through the Lake Ngami region, eastward to Tette.

*Note*.—*P. d. brockmani* should not be confused with the smaller, shorter-eared *P. revoili*, which belongs to the same section of the genus and occurs in the same region (forearm 41–45, ear 26–26·5, maxillary tooth-row 6·5–6·8 mm.).

*Petalia damarensis media*, subsp. n.

Probably the Abyssinian representative of the foregoing form, from which it differs by its conspicuously smaller size: total length of skull of type 20·6 mm., of lower jaw 13, maxillary tooth-row 6·8, forearm 45·5, ear from base of inner margin 29.

*Type*, ad. (skin), Harar, Abyssinia, 19 Jan., 1912, collected by Hr. G. Kristensen, presented by the Hon. N. C. Rothschild, B.M. 12. 2. 28. 1.

*Petalia gambiensis*, sp. n.

Tragus of the *P. thebaica* type, but species differing from any other form of the *thebaica* section by its remarkably small size. Forearm (type and topotype) 39–40·8 mm.,



third metacarpal 29, ear from base of inner margin 23-23.5, skull (total length) 18.5, maxillary tooth-row (crowns) 6.1-6.2.

*Type*, ad. (skin), Dialocote, French Gambia, 7 March, 1910, presented by G. Fenwick Owen, Esq., B.M. 11. 6. 10. 10.

*Note*.—Gambia is inhabited by two other species of *Petalia*, *P. hispida* and *P. macrotis*.

The following nineteen forms of *Petalia* are known to the writer:—

- I. *P. javanica* group:— $p_1$  large, equal in height to cusp 1 of  $m_1$ ; tragus lingulate or semilunate.
  - A. Indo-Malayan species.
    1. *P. javanica*, E. Geoff.—Java; Timor.
    2. *P. tragata*, K. A.—Borneo; Malay Peninsula.
  - B. Ethiopian species.
    3. *P. arge*, Thos.\*—Semliki R.; Ituri Forest; Benito R., French Congo; Fernando Po; Cameroons (Efulen; R. Ja); Old Calabar; Oban, S. Nigeria.
    4. *P. nana*, K. A.—Benito R., French Congo.
    5. *P. major*, K. A.—Cameroons (R. Ja).
- II. *P. hispida* group:— $p_1$  small; upper incisors trid; tragus falciform or semilunate. Ethiopian.
  6. *P. hispida*, Schreber.—From Egypt and Soudan, through British East Africa and Uganda, south to Ft. Johnston (Nyasa) and Upper Shiré R., west to Angola and the Guinea coast, as far as Gambia.
  7. *P. aurita*, K. A.—British East Africa and Somaliland.
  8. *P. grandis*, Pet.—From Zanzibar, west to French Congo and Old Calabar.
- III. *P. æthiopica* group:— $p_1$  small; upper incisors bifid; tragus semilunate (or nearly so). Ethiopian.
  9. *P. æthiopica æthiopica*, Dobson.—Kordofan and Shendy (Upper Nile).
  10. *P. æthiopica luteola*, Thos.†—Zanzibar; British East Africa; Uganda; west to Loanda (Pungo Andongo and Cassualalla).
  11. *P. macrotis* ‡, Dobson.—The Guinea coast representative of *P. æthiopica*: from Nigeria to Gambia.
- IV. *P. thebaica* group:— $p_1$  small; upper incisors bifid; tragus pyriform (free portion narrowest at base, its outer and inner margins evenly convex). Ethiopian.
  12. *P. thebaica adana*, K. A.—Aden.
  13. *P. thebaica thebaica*, E. Geoff.—Egypt (incl. Sinai).

\* Ann. & Mag. Nat. Hist. (7) xii. p. 633 (Dec. 1903).

† Ann. & Mag. Nat. Hist. (7) viii. p. 30 (July 1901).

‡ *Nycteris geoffroyi*, Desmarest (Mamm. p. 127; 1820), may be an earlier name of this species, but, unless the type should have been preserved, the identification appears rather doubtful.

14. *P. revoili*, Robin\*.—Erythrea; Somaliland; British East Africa; Uganda.
15. *P. capensis*, Smith.—From Zambesia, south to Transvaal, Zululand, Natal, and Pondoland, west to Mossamedes and Benguela.
16. *P. damarensis*, Pet.—Damaraland; Namaqualand; Lake Ngami; Tette.
17. *P. d. brockmani*, K. A.—Erythrea; Somaliland.
18. *P. d. media*, K. A.—Abyssinia (Harar).
19. *P. gambiensis*, K. A.—Gambia.

LXV.—On *Specimens of Cephalodiscus nigrescens supposed to have been dredged in 1841 or 1842.* By W. G. RIDEWOOD.

THE genus *Cephalodiscus* was founded upon material dredged by the 'Challenger' in 1876 from a single locality (Station 311) in the Straits of Magellan. The full report upon that material† was drawn up by Prof. W. C. M'Intosh and Dr. S. F. Harmer, and published in 1887 (5), the species being described as *Cephalodiscus dodecalophus*.

Since then twelve new species of *Cephalodiscus* have been described:—*C. gracilis*, *C. sibogæ*, and *C. levinseni*, by Harmer (3); *C. nigrescens*, by Lankester (4); *C. gilchristi* and *C. hodgsoni*, by Ridewood (6 and 7); *C. æquatus*, *C. in-æquatus*, *C. solidus*, *C. densus*, and *C. rarus*, by Andersson (1); and *C. indicus*, by Schepotieff (9).

Another species, somewhat resembling the *C. rarus* of Andersson, is stated to have been obtained on the second French Antarctic Expedition. The name given to it by Gravier (2) is *C. anderssoni*; but since the author does not enumerate its distinguishing features, the species cannot as yet be regarded as more than a *nomen nudum*.

Yet another species, of strongly marked facies, was obtained by the 'Scotia' during the Scottish National Antarctic Expedition, when at Station 346 (lat. 54° 25' S., long. 57° 39' W., depth 56 fathoms), in December 1903.

\* Bull. Soc. Philom. (7) v. p. 90 (1881). Name perhaps antedated by Heuglin's *Nycteris labiata* (N. Act. Ac. C. Leop.-Car. xxix. p. 5; 1861), the type of which I have not yet seen.

† The full report was preceded by a preliminary notice in the 'Annals and Magazine of Natural History,' (5) x. 1882, pp. 337-348, and another in the Report of the British Association meeting of 1882 (published 1883, pp. 596-597). The first published figures of *Cephalodiscus*, made from drawings supplied by Prof. M'Intosh, appeared in E. R. Lankester's article "Polyzoa" in the 'Encyclopædia Britannica,' ed. 9, xix. 1885, figs. 8-10.

The description of this species has not yet been published, but a report upon it is in preparation.

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In May of the present year, when examining some specimens of *Cephalodiscus* dredged on the Swedish Antarctic Expedition and received by the British Museum (Natural History) from Stockholm in exchange for other specimens, Mr. R. Kirkpatrick alluded to the fact that among the Pterobranchia in his charge were three bottles of a kind of *Cephalodiscus*, apparently part of the collection of material obtained on the 'Erebus' and 'Terror' Expedition in the Antarctic Ocean in the years 1839-1843. The specimens were shown to Dr. S. F. Harmer, the Keeper of the Department of Zoology in the Museum, who recognized them as similar to those of *Cephalodiscus nigrescens* dredged by the 'Discovery' in the Antarctic Ocean, and submitted them to me for examination and report. I am pleased to be able to confirm Dr. Harmer's identification of the specimens as *C. nigrescens*, and I take this opportunity of thanking him for allowing me to publish the present note.

For convenience of reference the specimens may be distinguished as A, B, and C.

*Specimen A* (see figure, p. 552) is a dark brown piece of colony with four branches. Greatest measurements 68 by 39 mm. ; longest branch 42 mm. long and 11 mm. wide ; second longest branch 21 mm. long and 10 mm. wide ; the other two branches are short. The piece is in good condition, with the projecting peristomial tubes and lips intact. The zooids are numerous, blackish, in fair state of preservation, each with three or four buds. The size of the body and the proportions of the buccal shield are the same as those recorded in the description of *C. nigrescens* in the 'Discovery' Expedition Report (7, p. 28).

*Specimen B* is of a paler colour than A : it is evidently a young colony, consisting of but one branch ; the attached base contains included stones and shells ; size 33 mm. by 22 mm. ; preservation good ; zooids plentiful.

*Specimen C* consists of two pieces of colony, very pale in colour, in poor condition, with no branches remaining and with the peristomial tubes broken off. Both pieces are massive in character. The larger measures 64 by 41 mm. ; stumps of three branches are recognizable ; sandy particles are embedded in the basal end of it. The smaller piece measures 58 by 40 mm. Both pieces appear to have been

slashed with a knife in various directions. Scarcely any zooids remain in the tubes, and such as can be found are in a very bad state of preservation.

The bottles containing specimens A and B bear very old brown labels. That on A is illegible, but a second and more recent label affixed to the bottle bears the words "label illegible — probably Antarctic Exp. — 98. 7. 26, R. K.," meaning that Mr. R. Kirkpatrick, when working at the



*Cephalodiscus nigrescens* (specimen A), supposed to have been dredged in 1841 or 1842 on the 'Erebus' and 'Terror' Expedition. Nat. size.

collection on July 26th, 1898, came to the conclusion that the material was part of the collection obtained by Ross on his Antarctic Expedition in 1839-43.

The label on bottle B bears the words "Antarctic Sea, Antarctic Exp.," in the original handwriting, but the rest of the label is illegible. It is interesting, however, to note that in size and colour and the character of the handwriting



this label agrees exactly with the labels on two other bottles in the Museum collection—one of which, containing a specimen of *Bugula* (*B. reticulata*, Busk), bears the words "Antarctic Expedition—Admiralty—74.5° S., 174.5° E., 300 fms.," and the other, containing a Hexactinellid sponge (*Anoxycalyx ijimai*, Kirk.), "Antarctic Exp.—Admiralty—72° S., 175½° E."

The label on bottle C is evidently of more recent date than those on bottles A and B. It bears the words "Antarctic Exped.—Admiralty," probably copied from an earlier label. In a different handwriting are the words "No Sponge," and in a third hand are the words, written in pencil, "*Cephalodiscus* (Polyzoan)?" Mr. Kirkpatrick informs me that these last two words are in the handwriting of Mr. S. O. Ridley, who was in charge of the Polyzoa in the British Museum until 1887. Credit is therefore due to Mr. Ridley for his recognition, even though qualified, of a specimen of *Cephalodiscus* so unlike the *Cephalodiscus dodecalophus* of the 'Challenger.'

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*Cephalodiscus nigrescens* was first described by Lankester in 1905 (4), and a fuller account, by Ridewood, was published in 1907 in the reports of the National Antarctic Expedition (7). The whole of the material there described was obtained by the 'Discovery' in 1902 off Coulman Island, near Victoria Land, in the Ross Sea in the Antarctic Ocean, at a depth of 100 fathoms.

In connection with the three specimens of *C. nigrescens* now under consideration, it is of interest to note that Coulman Island (about 73½° S., 170° E) was discovered by Captain Sir James Clark Ross, in charge of the 'Erebus' and 'Terror' Expedition, on January 17th, 1841, when at a distance of 100 miles to the west of it (8, vol. i. p. 199). On January 18th soundings were taken in 230 fathoms in 73° S., 176° E, and small shells and pieces of coral and a *Nymphon* were obtained. During the night they sounded again, and found a sandy bottom at a depth of 180 fathoms. Bealmed off Coulman Island on January 19th, they put down the dredge in 270 fathoms (8, p. 201), and obtained broken pieces of rock, living corals, and "Corallines, *Flustra*, and a variety of marine invertebrate animals." They sounded again on January 20th, when 25 miles off Coulman Island, and some fragments of starfish and pieces of coral were got from a muddy and sandy bottom (320 fathoms). On January 22nd the dredge was put down on a bottom of

300 fathoms, and after trailing for two or three hours "brought up many animals, some corallines, and a quantity of sand, mud, and small stones . . . and several entirely new forms of creatures, of which accurate drawings\* were taken by Dr. Hooker" (8, vol. i. p. 207). The voyage after this was southward towards Franklin Island and away from Coulman Island.

After the first attempt to reach the Pole the vessels came back to Tasmania, passed on to Port Jackson (July 1841), and stayed about three months in the northern extremity of New Zealand (August–October 1841).

They commenced a fresh attempt to reach the Pole in November 1841, and traversed the Ross Sea a second time in February and March 1842. On February 16th, 1842, they reached  $75^{\circ}$  S.,  $187^{\circ}$  W. ( $=173^{\circ}$  E.), and in the afternoon they hove to, and the dredge was put down in 290 fathoms, and "many curious invertebrate animals and a small fish were taken." The voyage was then continued southward and westward, and the region of Coulman Island was left. On the second attempt to reach the Pole they thus got within  $3^{\circ}$  longitude of Coulman Island (8, vol. ii. pp. 195–6), but not so close to it as on January 20th, 1841.

From these data the conclusion may be drawn that if *Cephalodiscus nigrescens* were then, as now, peculiarly abundant in the neighbourhood of Coulman Island, the specimens A–C were in all probability dredged either in January 1841 or in February 1842, and from a depth of about 300 fathoms.

The species, however, as recent events show, is not peculiar to that district, for on the second French Antarctic Expedition (1908–10) *Cephalodiscus nigrescens* was found in abundance in the South-American part of the Antarctic Ocean in lat.  $68^{\circ}$  S., long.  $70^{\circ} 20'$  W. Paris (2), a region widely remote from the Ross Sea.

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\* Hooker's original drawings are in the Natural History Museum, but there is no drawing of *Cephalodiscus* among them.

- (3) HARMER, S. F. "The Pterobranchia of the 'Siboga' Expedition, with an Account of other Species." *Siboga-Expeditie, Monogr. xxvi. bis*: Leiden, July 1905, pp. 132, fourteen plates and two text-figures.
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- (7) —. "Pterobranchia: *Cephalodiscus*." *National Antarctic Expedition, Natural History*, vol. ii., London, 1907, pp. 1-67, seven plates and seventeen text-figures.
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*Recent Foreign and Colonial Natural History Periodicals.*

- (1) *Annals of the Transvaal Museum*. May 1912.
- (2) *The Journal of the East African and Uganda Natural History Society*. Vol. i. no. 2. 1911.
- (3) *Annals of the Queensland Museum*. No. 10. November 1911.

(1) INCLUDES a First Check-List of the Flowering Plants and Ferns of the Transvaal and Swaziland, by Joseph Burtt-Davy and Mrs. Reno Pott-Leendertz (3240 species, included in 920 genera and 157 families).

(2) Includes a variety of papers on Game-Birds of the Protectorate, on Collecting and Preserving Fishes, the Central African Stone-Curlew, Mimicry in East African Butterflies, the smaller fauna of Mount Elgon, Spitting Cobra, European migrants in British East Africa, the microscopical structure of Diatomite, random observations of chameleons, melanism in *Felis serval*, white water-buck, *Gazella grantii*, Kavirondo Potto, and Honey-Guides. Most of these papers are well illustrated, and the frontispiece gives an interesting flashlight photo of a lion going down to drink.

(3) Another miscellaneous assortment of papers on fossils, mammals, snakes, batrachians, fishes, Coleoptera, Lepidoptera, Arachnida, Cestodea, &c.

*Records of the Western Australian Museum and Art Gallery.*

Edited by the Director, BERNARD H. WOODWARD. Vol. I. Part 2.  
 Printed by Order of the Trustees. Perth, 1912. Pp. 39-104,  
 pls. vi.-xvi. Price 2s. 6d.

THE number of scientific periodicals is increasing by leaps and bounds, and we have perhaps twenty at the present time for each one a few years ago; and it is becoming ever more difficult to keep abreast of this mass of fresh literature. The part before us contains much interesting matter by L. Glauert on Australian Fossils, notes on Western Australian Fishes by Allan R. McCulloch, and a list of Birds observed on Durré and Bernier Islands by Otto Lipfert.

W. F. K.

*Distribution and Origin of Life in America.* By ROBERT FRANCIS SCHARFF, Ph.D., B.Sc. London: Constable & Co. 1911.  
 Price 10s. 6d.

THE title of this book is unfortunate, for its pages have nothing to tell us of the origin of life either in America or anywhere else. It is a work, and in many respects a most excellent work, on the migrations of animals to and from the American continent, and ranging in time from the earliest geological records to the present day.

Dr. Scharff has garnered an immense store of facts, for which alone he has earned the gratitude of all who are interested in the intricate problems presented by the study of the geographical distribution of animals. But we are not so enamoured of his interpretation of these facts, and our imagination is paralyzed by the audacious way in which he raises and sinks "land-bridges," often of vast area, to account for the existence of this or that closely related group of animals in remote and isolated areas of the globe. It is not that we do not believe in "land-bridges," there is no room for doubt on the subject; but we feel that Dr. Scharff has postulated more than nature ever made. We certainly cannot follow him, for example, in his contention that the primitive elephants made their way into America by a Pacific land-bridge instead of by way of Bering Strait. Nor do we agree with him that Greenland was the birthplace of the reindeer and that the hares originated in high arctic latitudes. Still more do we protest against his suggestion that the typical American deer are the descendants of the same stock which gave rise to the roebuck: there is absolutely nothing to justify such a view.

But while we differ widely from Dr. Scharff in the interpretation of his evidence, we congratulate him on the vast array of facts which he has so laboriously brought together.



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# CONTENTS OF NUMBER 59.—*Eighth Series.*

	Page
LVIII. Notes on the <i>Apidæ</i> (Hymenoptera) in the Collection of the British Museum, with Descriptions of new Species. By GEOFFREY MEADE-WALDO, M.A. ....	461
LIX. Observations on living Gorgonias ( <i>Gorgonia verrucosa</i> ) occurring in the English Channel. By J. STUART THOMSON, Ph.D., F.L.S., F.R.S.E., Lecturer and Senior Demonstrator in Zoology, Victoria University of Manchester .....	479
LX. Descriptions and Records of Bees.—XLVII. By T. D. A. COCKERELL, University of Colorado .....	484
LXI. A Revision of the Pœciliid Fishes of the Genera <i>Rivulus</i> , <i>Pterolebias</i> , and <i>Cynolebias</i> . By C. TATE REGAN, M.A. ....	494
LXII. New Species of Heterocera from Costa Rica.—XVIII. By W. SCHAUS, F.Z.S. ....	509
LXIII. Notes on Fossorial Hymenoptera.—XI. By ROWLAND E. TURNER, F.Z.S., F.E.S. ....	533
LXIV. Brief Diagnoses of Eight new <i>Petalia</i> , with a List of the known forms of the Genus. By KNUD ANDERSEN .....	546
LXV. On Specimens of <i>Cephalodiscus nigrescens</i> supposed to have been dredged in 1841 or 1842. By W. G. RIDEWOOD .....	550

## BIBLIOGRAPHICAL NOTICES.

Recent Foreign and Colonial Natural History Periodicals .....	555
Records of the Western Australian Museum and Art Gallery. Edited by the Director, BERNARD H. WOODWARD. Vol. I. Part 2.	556
Distribution and Origin of Life in America. By ROBERT FRANCIS SCHARFF, Ph.D., B.Sc. ....	<i>ib.</i>

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LXVI.—*Descriptions of new Species of Pyralidæ of the Subfamily Pyraustinæ.* By Sir GEORGE F. HAMPSON, Bart., F.Z.S., &c.

[Continued from p. 20.]

(6f) *Lygropia phæoneuralis*, sp. n.

Head and thorax ochreous yellow ; palpi with the second joint fuscous at sides ; pectus and legs whitish, the fore tibia tinged with fuscous above ; abdomen ochreous, the ventral surface white. Fore wing ochreous slightly irrorated with brown, the veins obscurely streaked with brown ; traces of a dark, oblique, slightly waved antemedial line ; an indistinct dark discoidal spot ; postmedial line indistinct, dark, oblique from costa to vein 4, then curved inwards to below end of cell and oblique to inner margin ; a fine dark terminal line. Hind wing pale ochreous, with a fine dark terminal line.

*Hab.* PARAGUAY, Sapucay (IV. Foster), 12 ♂ type. *Exp.* 22 mm.

(7a) *Lygropia melanoperalis*, sp. n.

♀. Uniform orange-yellow ; palpi white, with the third joint black ; pectus, legs, and ventral surface of abdomen white, the fore tibiæ and tarsi tinged with fuscous.

*Hab.* BR. GUIANA, Potaro R. (Kaye), 1 ♀ type. *Exp.* 24 mm.

(10 a) *Lygropia straminea*, sp. n.

♂. Head, thorax, and abdomen bright ochreous yellow ; palpi with the base of second joint and the third joint black ; fore legs and mid femora streaked with fuscous. Fore wing bright ochreous yellow, with small black spots at base of cell, in middle of cell, and at lower angle. Hind wing bright ochreous yellow.

*Hab.* TRANSVAAL, Kranspruit (*Janse*), 1 ♂ type, Johannesburg (*Cooke*), 1 ♂. *Exp.* 26 mm.

(16 b) *Lygropia tetraspilalis*, sp. n.

♀. Head, thorax, and abdomen white tinged with golden yellow ; palpi orange ; fore tibiae with black band at extremity. Fore wing whitish tinged with golden yellow ; sub-basal, antemedial, and postmedial small black spots on costa and a small discoidal spot ; a curved diffused orange antemedial line ; a curved orange band just beyond the cell from below costa, where it is diffused inwards to inner margin ; postmedial line orange, outwardly oblique from below costa to vein 2, then diffused to inner margin near tornus ; a large diffused orange subapical patch ; a fine orange terminal line ; cilia orange, with pale tips. Hind wing whitish tinged with golden yellow ; a diffused sinuous orange antemedial line ; a broad orange band from lower angle of cell to inner margin ; postmedial line orange, incurved below costa, then excurved and ending at tornus ; a large elliptical subapical patch extending to vein 2 ; a fine orange terminal line ; cilia orange at base, pale at tips.

*Hab.* NATAL, Durban (*Jeffery*), 1 ♀ type. *Exp.* 22 mm.

(25 a) *Lygropia flavinotalis*, sp. n.

♀. Head and thorax black-brown ; palpi yellowish white at base and at extremity of second joint ; pectus and legs yellowish white, the tibiae fuscous at extremity ; abdomen black-brown, with slight greyish segmental lines, the ventral surface yellowish white. Fore wing black-brown with a purplish gloss ; a curved pale yellow antemedial line expanding towards costa ; a yellow bar from middle of costa across the cell ; a wedge-shaped yellow patch from costa beyond middle to vein 3, with a slight yellow bar below it from vein 2 to above inner margin and an oblique yellow bar beyond it from costa to vein 7 ; cilia yellow above tornus. Hind wing black-brown with a purplish gloss ; a quadrate yellowish white discoidal patch ; a yellowish postmedial line,

slightly excurved from costa to vein 2, then retracted to below angle of cell and oblique to above tornus; cilia yellowish at submedian interspace; the underside yellowish to beyond the postmedial line, which is strong, black, and conjoined at lower angle of cell to the blackish discoidal patch.

*Hab.* NIGERIA, Sapele (*Sampson*), 1 ♀ type. *Exp.* 22 mm.

(25 b) *Lygropia hyalostictalis*, sp. n.

♂. Head and thorax fuscous brown; palpi at base, pectus, and legs whitish; abdomen with the basal half fuscous brown, the terminal half greyish, the ventral surface white. Fore wing fuscous brown with a cupreous gloss; a slight whitish antemedial mark in cell and another below the cell; a quadrate hyaline spot in middle of cell and a lunule below the cell, concave towards base; a postmedial hyaline band between veins 7 and 3. Hind wing fuscous brown with a cupreous gloss; a hyaline lunule below middle of cell, concave towards base, and another beyond the cell between veins 6 and 3.

*Hab.* S. NIGERIA, Lagos (*Strachan*), 1 ♂ type. *Exp.* 28 mm.

(30 c) *Lygropia epipaschiodes*, sp. n.

♂. Head and thorax white irrorated with a few dark brown scales; palpi black except at base; antennæ blackish; fore and mid tibiæ and fore tarsi spotted with black in front; abdomen white, dorsally tinged with brown except at base. Fore wing white slightly irrorated with dark brown; a diffused dark subbasal line and short streak below costa; diffused, somewhat dentate, erect antemedial and medial lines; a similar postmedial line, with the area beyond it black-brown, leaving some white on termen above and below middle; cilia white, with some black-brown at tips towards apex. Hind wing white, the inner area tinged with brown, the termen suffused with fuscous, narrowing to tornus; cilia whitish, with a dark line near base, wholly brown except at base towards apex.

♀. Fore wing with more white on terminal area, leaving a black-brown band beyond postmedial line and spot at middle; hind wing wholly suffused with brown.

*Hab.* NEW GUINEA, Kapaur (*Doherty*), 1 ♂ type, Dinawa (*Pratt*), 1 ♀. *Exp.*, ♂ 22, ♀ 28 mm.

(30 e) *Lygropia scopariodes*, sp. n.

♂. Head and thorax white mixed with pale brown; palpi black, white at base and with some white at tips; antennæ blackish; fore tibiæ and tarsi marked with brown; abdomen white dorsally, slightly tinged with brown. Fore wing white irrorated with pale brown; a waved brown antemedial line; a dark point in middle of cell and white discoidal spot defined by brown, with a slight dark mark above it on costa; a dark medial shade from cell to inner margin; a minutely dentate postmedial line somewhat oblique from costa to vein 5; a subterminal bar from costa to vein 5 and darker somewhat wedge-shaped patch from vein 3 to tornus, a dark bar just before termen from costa to vein 5, where it expands into a spot; a terminal series of dark points. Hind wing white, the terminal area tinged with brown, narrowing from costa to submedian fold; the underside with traces of curved postmedial line on costal half.

♀. Hind wing with the postmedial line showing above, the terminal area strongly suffused with fuscous from apex to submedian fold.

*Hab.* BR. NEW GUINEA, Dinawa (*Pratt*), 1 ♂ type, Mt. Kebea (*Pratt*), 1 ♀. *Exp.*, ♂ 30, ♀ 34 mm.

(30 f) *Lygropia hypoleucalis*, sp. n.

Greyish fuscous; palpi at base, pectus, legs, and ventral surface of abdomen white. Fore wing with faint traces of a curved antemedial line; an indistinct dark spot in middle of cell and discoidal lunule; faint traces of a postmedial line excurved from costa to vein 4, then incurved. Hind wing with the costal area white to beyond middle; cilia whitish at tips. Underside of fore wing white tinged with fuscous; hind wing white, with indistinct discoidal spot.

*Hab.* FR. GUIANA, Cayenne (*Schaus*), 1 ♂ type, type ♀ in Coll. *Schaus*. *Exp.* 20 mm.

(32 a) *Lygropia bicincta*, sp. n.

♂. Head, thorax, and abdomen ochraceous; palpi white, with oblique black band on second joint; maxillary palpi and frons blackish; abdomen with two dorsal black segmental lines before anal segment, which has a small blackish spot towards extremity; pectus, legs, and ventral surface of abdomen white, the fore tibiæ with black band, the mid tibiæ black at base. Fore wing ochraceous, the costa black towards base; a subbasal black point on inner margin;



antemedial line slight, oblique to median nervure, then almost erect; a small black discoidal lunule; postmedial line blackish, excurved between veins 5 and 2, then bent inwards to near lower angle of cell and oblique to inner margin; a black terminal line; cilia chequered ochreous and black. Hind wing ochreous; a black discoidal point; postmedial line slight, blackish, bent outwards between veins 5 and 2, then retracted to near lower angle of cell and oblique to above tornus; a black terminal line and line at middle of cilia which are white at tips.

*Hab.* SINGAPORE (Ridley), 1 ♂ type. *Exp.* 20 mm.

(32 b) *Lygropia ochrotalis*, sp. n.

♀. Head, thorax, and abdomen pale ochreous slightly tinged with fulvous; palpi blackish at tips; fore tibiæ fuscous at extremities. Fore wing pale ochreous, the costal area tinged with fulvous; a somewhat diffused oblique sinuous antemedial line; a black point in middle of cell and small discoidal lunule; postmedial line rather diffused, fuscous, bent outwards and minutely dentate between veins 5 and 2, then retracted to below angle of cell and sinuous to inner margin; a lunulate black terminal line. Hind wing pale ochreous; an oblique black discoidal bar; postmedial line rather diffused, fuscous, bent outwards and minutely dentate between veins 5 and 2, then retracted to below angle of cell and sinuous to above tornus; the apex slightly tinged with fuscous; a punctiform fuscous terminal line.

*Hab.* PANAMA, Cana Mines (Tylecote), 1 ♀ type; BRAZIL, Amazons (Giffard), 1 ♀. *Exp.* 26 mm.

(32 c) *Lygropia anæmicalis*, sp. n.

♀. Yellowish white, palpi tinged with fuscous at sides. Fore wing very faintly irrorated with fuscous, the costal area slightly tinged with fulvous; a slight dark antemedial line, oblique from costa to median nervure, then somewhat sinuous, a dark point beyond it in cell; a black discoidal lunule; a slight dark postmedial line excurved from costa to vein 3, then retracted to below end of cell and sinuous to inner margin. Hind wing faintly tinged with fuscous; an oblique fuscous discoidal bar; a somewhat diffused postmedial line, retracted at vein 3 to beyond lower angle of cell, then slightly sinuous to above tornus; a fine dark terminal line.

*Hab.* GAZALAND, Chirinda Forest (Marshall), 1 ♀ type. *Exp.* 30 mm.

(32 d) *Lygropia leucocephalis*, sp. n.

♀. Head white; palpi greyish ochreous, white at base; antennæ ochreous; thorax greyish ochreous, the pectus, femora, and tarsi white; abdomen greyish ochreous, whitish ventrally. Wings uniform pale glossy brownish ochreous; cilia white at base and with brownish tips, a slight dark line at middle; fore wing with the costal area whitish at middle and a faint dark discoidal lunule.

*Hab.* BORNEO, Sandakan (*W. B. Pryer*), 1 ♀ type. *Exp.* 30 mm.

(32 e) *\*Lygropia obscuralis*, sp. n.

♂. Pale dull brown; fore coxæ hollowed out and enclosing tufts of ochreous hair; anal tuft very long and ochreous. Fore wing irrorated with darker scales; traces of sinuous medial and postmedial line, the latter bent outwards round an obscure discoidal spot; an indistinct terminal series of dark points. Hind wing semihyaline brownish, the termen suffused with brown from apex to submedian fold.

*Hab.* VENEZUELA, Cucuta. *Exp.* 34 mm. Type in Coll. Rothschild.

(4 c) *Agathodes minimalis*, sp. n.

♂. Head and thorax brown mixed with ochreous grey; pectus and legs white, the fore tibiae and tarsi banded with brown; abdomen brown mixed with ochreous grey, the medial segments darker, the ventral surface whitish. Fore wing ochreous grey thickly irrorated with fuscous, the basal half of costa fuscous, a fuscous patch on inner medial area; a pale oblique antemedial line from submedian fold to inner margin; a slight, pale, oblique discoidal striga defined by black; a pale oblique postmedial line from vein 2 to inner margin, defined on inner side by black; a rather diffused oblique black fascia across apical area; cilia with black line at middle and blackish tips on apical half. Hind wing semihyaline white, the termen tinged with brown; cilia with a punctiform black line at middle.

*Hab.* S. NIGERIA, Lagos, Ebute Meta (*Boag*), 1 ♂ type. *Exp.* 22 mm.

(9 a) *Glyphodes cæruleiceps*, sp. n.

Head greenish blue, the frons white below; palpi fulvous, white above and below and with black streak at sides; thorax

and abdomen yellow-green, the anal tuft black; pectus, legs, and ventral surface of abdomen bluish white, the fore femora and tibiæ at extremities and the mid femora at extremities and tibiæ at base fulvous. Fore wing yellow-green, the costa pale fulvous; a black discoidal point and terminal series of points; cilia fuscous, whitish at tips. Hind wing yellow-green; a terminal series of black points; cilia fuscous, whitish at tips. Underside of fore wing with the fringe of hair from costa of male ochreous white; both wings with some fuscous suffusion on terminal area except towards tornus.

*Hab.* BR. N. GUINEA, Ekeikei (*Pratt*), 1 ♂, 1 ♀, Mt. Kebea (*Pratt*), 6 ♂, 1 ♀ type. *Exp.* 26–30 mm.

(21 b) \**Glyphodes subterminalis*, sp. n.

Fore wing of male with tuft of long hair at base of costa below; hind tibiæ normal.

White; palpi except at base, maxillary palpi, sides of frons, and a stripe on shoulders orange; antennæ fulvous; fore tibiæ and tarsi yellow; abdomen with the anal tuft tinged with fuscous in male. Fore wing with fulvous fascia on costa; the veins brown, the part of vein 1 *a* recurved to 1 *b* prominently brown; the discal area thinly scaled; a curved brown subterminal line, the area beyond it thickly scaled and mixed with fuscous; a terminal brown line and some blackish points towards apex; cilia brown. Hind wing semihyaline; a curved subterminal line, the area beyond it thickly scaled and mixed with fuscous; a terminal brown line; cilia mixed with brown.

*Hab.* BRAZIL, São Paulo. *Exp.* 28 mm. Type in Coll. Rothschild.

(32 c) *Glyphodes holophænica*, sp. n.

♂. Head, thorax, and abdomen dark brown, with a slight greyish tinge; anal tuft with black mixed; palpi pure white at base; pectus, femora, and ventral surface of abdomen pure white. Fore wing deep purple, the costa browner, the cilia cupreous brown. Hind wing brown, the terminal area deep purple; a faint hyaline shade before the very indistinct dark postmedial line, which is excurved to vein 2, then bent outwards to termen; cilia cupreous brown; the underside greyish brown, the terminal area cupreous brown with a faint purplish tinge, emitting a wedge-shaped dark patch to the discocellulars.

*Hab.* W. COLOMBIA, Jimenez, 2 ♂ type. *Exp.* 32 mm.

(32 d) *Glyphodes purpurea*, sp. n.

♂. Head, thorax, and abdomen grey-brown, the anal tuft with black mixed; palpi pure white at base; pectus, femora, tarsi, and ventral surface of abdomen white, the last tinged with brown towards extremity. Fore wing brown shot with deep purple; a very faint oblique paler patch between veins 5 and 1 before the very indistinct dark postmedial line, which is incurved at discal fold, excurved between veins 5 and 2, then oblique; cilia cupreous brown. Hind wing greyish brown, the terminal area cupreous brown shot with purple, its inner edge oblique from costa beyond middle to tornus.

*Hab.* COLOMBIA, Rio Dagua (*Rosenberg*), 1 ♂ type. *Exp.* 36 mm.

(38 a) *Glyphodes aurogrisealis*, sp. n.

♀. Head, thorax, and abdomen grey-brown; palpi at base and throat white; tarsi ochreous; abdomen with the terminal segment yellowish white; the anal tuft black above, fulvous yellow below. Wings grey-brown shot with golden yellow; fore wing with a yellow band just beyond the cell between veins 7 and 2, bent round lower angle of cell and with its outer edge minutely dentate; hind wing with band beyond the cell from costa to submedian fold, towards which it narrows, its outer side excurved between median nervules, its inner side sending a tooth in cell to near base on under-side.

*Hab.* COSTA RICA (*Underwood*), Juan Vinas (*Schaus*), 1 ♀ type. *Exp.* 30 mm.

(41 a) *Glyphodes clavata*, sp. n.

*Eudiotis nitidalis*, Druce, Biol. Centr.-Am., Het. ii. p. 231 (part.), nec Cram.

♂. Head, thorax, and abdomen dark cupreous brown, the last with whitish band on second segment, the anal segment whitish, the tuft black at tip; palpi white at base; pectus, legs, and ventral surface of abdomen white, the fore femora and tibiae tinged with brown. Fore wing cupreous brown with a purple tinge; an oblique semihyaline yellow band from below costa beyond the cell to middle of inner margin, its outer edge excurved from vein 5 to below 3; cilia with a fine pale line at base and whitish tips towards tornus. Hind wing semihyaline yellow, the terminal area cupreous



brown tinged with purple and with curved waved inner edge ; cilia whitish, with a slight dark line through them.

*Hab.* GUATEMALA, V. de Atitlan (*Champion*), 2 ♂ type, Godman-Salvin Coll. *Exp.* 26-28 mm.

(42 b) \**Glyphodes orthozonalis*, sp. n.

♂. Head and thorax yellowish brown ; palpi at base and throat white ; legs whitish ; abdomen fuscous brown, the second segment with white line at base, the terminal segment and ventral surface yellowish white, the anal tuft whitish, fulvous yellow and fuscous towards tip. Fore wing yellowish brown ; a broad erect yellow band just beyond the cell from costa to inner margin with sinuous edges ; a fine yellowish line at base of cilia. Hind wing semihyaline yellowish, tinged with brown on apical part of termen ; a brown terminal line and a line through the cilia.

*Hab.* BOLIVIA, R. Tanampaya (*Garlepp*). *Exp.* 32 mm. Type in Coll. Rothschild.

(43 b) *Glyphodes hemicitralis*, sp. n.

♂. Head and thorax dark reddish brown ; abdomen pale red-brown, the anal tuft black ; palpi at base, pectus, legs, and ventral surface of abdomen white. Fore wing brown with a cupreous gloss ; a broad, very oblique, yellow band from beyond the cell to inner margin near base, its upper edge irregular, its outer incurved below vein 3. Hind wing yellow, with cupreous brown terminal band, broad at apex, narrowing to a point at inner margin at vein 1.

*Hab.* BR. GUIANA, Rockstone (*Kaye*), 1 ♂ type. *Exp.* 28 mm.

(44 a) *Glyphodes eurytornalis*, sp. n.

♂. Head, thorax, and abdomen black-brown with a cupreous gloss, the vertex of head with some whitish ; palpi pure white at base ; pectus, legs, and ventral surface of abdomen white, the fore femora and tibiæ on inner side and the mid tibiæ brownish ; anal tuft ochreous, brown and whitish mixed. Fore wing semihyaline white, the costal and terminal areas very broadly cupreous black-brown, the apex of the triangular white area curving up to vein 7, the inner edge of the terminal band bent inwards at vein 2 ; cilia greyish. Hind wing semihyaline white ; a cupreous

black-brown terminal band, narrowing to a point at vein 1; cilia greyish.

*Hab.* GRENADA, Balthassar (*H. H. Smith*), 2 ♂; PARAGUAY, Sapucay (*Foster*), 3 ♂ type. *Exp.* 32 mm.

(44 b) *Glyphodes æditornalis*, sp. n.

*Eudiotis lucidalis*, Druce, Biol. Centr.-Am., Het. ii. p. 230 (part.), nec Hübn.

♂. Head, thorax, and abdomen black-brown with a purplish gloss; palpi white at base; pectus, legs, and ventral surface of abdomen white, the fore femora and tibiæ on inner side and the mid tibiæ tinged with brown; anal tuft brown and rufous. Fore wing semihyaline white, the costal area and termen very broadly black-brown with a purplish gloss, the apex of the triangular white patch curving upwards to vein 6, the inner edge of the terminal band curving inwards at vein 2; cilia greyish. Hind wing semihyaline white, with terminal black-brown band tinged with purple and narrowing to a point at tornus.

*Hab.* GUATEMALA, San Geronimo (*Champion*), 4 ♂ type, Godman-Salvin Coll.; COLOMBIA, 1 ♂. *Exp.* 30-32 mm.

(46 a) *Glyphodes equicincta*, sp. n.

*Eudiotis lucidalis*, Druce, Biol. Centr.-Am., Het. ii. p. 230 (part.), nec Hübn.

♂. Head, thorax, and abdomen black-brown; palpi at base, pectus, legs, and ventral surface of abdomen white. Fore wing semihyaline white, the costal area very broadly black-brown with a slight purplish gloss, the terminal band moderate and with even inner edge, the apex of the triangular white area curving up to vein 7; cilia white at tips. Hind wing semihyaline white, with rather narrow, evenly curved, terminal black-brown band glossed with purple; cilia white at tips.

*Hab.* MEXICO, Jalapa (*Trujillo*), 1 ♂ type, Godman-Salvin Coll. *Exp.* 36 mm.

(48 a) *Glyphodes euryzonalis*, sp. n.

♂. Head and thorax black-brown with a purple gloss, the patagia with tuft of white hair below, the metathorax white; palpi at base, pectus, and legs white, the fore femora and tibiæ on inner side and the mid tibiæ on outer side black-brown: abdomen white, the two terminal segments and anal

tuft black-brown. Fore wing semihyaline white, the costal and terminal areas very broadly black-brown with a brilliant purple gloss, the apex of the white triangular area with oblique series of faint whitish points between it and vein 7. Hind wing semihyaline white; a terminal black-brown band with brilliant purple gloss, very broad at costa, narrowing to a point at vein 1; cilia pure white to vein 3, with their bases dark at apex, wholly dark from vein 3 to tornus.

*Hab.* W. COLOMBIA, Jiminez, 1 ♂ type. *Exp.* 31 mm.

(51 a) \**Glyphodes interpositalis*, sp. n.

Differs from *G. hyalinis* in the point of the white area of fore wing being more upcurved below apex, the brown costal fascia being broader at that point; the terminal band incurved and dilated towards tornus. Hind wing with a small brown patch at apex only.

*Hab.* BRAZIL, São Paulo (Jones). *Exp.* 30 mm. Type in Coll. Rothschild.

(60 a) *Glyphodes albifascialis*, sp. n.

♀. Head and thorax white; palpi (except at base), sides of frons, antennæ, and stripes on shoulders golden-brown; fore tibiæ banded with brown; abdomen white, with series of golden-brown dorsal patches. Fore wing golden-brown; a white patch at base of inner margin; a wedge-shaped white patch in end of cell; a dark brown discoidal lunule; a white fascia in submedian fold from before middle to near termen; white fasciæ above and below vein 6 from end of cell to near termen, where they are met by an oblique fascia from apex; subterminal dentate white marks below veins 5, 4, 3; cilia with fine white line at base and silvery tips. Hind wing semihyaline white, with rather narrow dark brown terminal band from apex to submedian fold.

*Hab.* CUBA, Santiago (Schaus), 1 ♀ type. *Exp.* 28 mm.

(63 a) *Glyphodes decipiens*, sp. n.

♂. Only distinguishable from *G. laticostalis* by the antennæ being simple, the anal tuft blackish at extremity.

*Hab.* MALACCA, Penungah; CERAM (Wallace), 1 ♂ type; SULA MANGOLI (Doherty); GT. KEY (Webster). *Exp.* 38 mm.

(63 b) *Glyphodes chalcicraspis*, sp. n.

Head, tegulæ, and shoulders golden bronze; palpi white

at base; thorax white; the fore tibiæ with dark brown bands at base and extremity; abdomen white. Fore wing semihyaline white with golden-bronze costal fascia, its lower edge indented by slight white points at middle of cell and discocellulars; the termen silvery, with a series of fuscous striæ just before it. Hind wing semihyaline white; a fuscous discoidal point; the termen silvery, with a series of fuscous striæ just before it.

*Hab.* BR. N. GUINEA, Mt. Kebea (*Pratt*), 3 ♂, 4 ♀ type, Ekeikei (*Pratt*), 1 ♀. *Exp.* 36-42 mm.

(66 a) *Glyphodes hololeuca*, sp. n.

♂. Head, thorax, and abdomen white. Fore wing semihyaline sparsely clothed with white scales, the termen rather more thickly scaled and defined on inner side by a faint brownish line. Hind wing semihyaline, sparsely clothed with white scales, the termen more thickly scaled and defined on inner side by a faint slightly waved brownish line; a faint brownish discoidal point.

*Hab.* GRAND CAYMAN (*Nicholl*), 1 ♀ type. *Exp.* 24 mm.

(69 b) *Glyphodes ocelliferalis*, sp. n.

White; palpi, except at base, and frons black; vertex of head, antennæ, and tegulæ fulvous; femora, fore tibiæ, and base of mid and hind tibiæ blackish; abdomen tinged with fulvous towards extremity, the anal tuft black. Fore wing with the costal area fulvous, expanding into black-edged and black-centred spots in cell before and at middle and on discocellulars where the spot extends to vein 2; the apex fulvous; small black subterminal spots above veins 4 and 5 and a larger spot above vein 2. Hind wing with black-edged fulvous discoidal spot extending from vein 6 to 2; the termen and cilia towards apex tinged with orange; subterminal black points above veins 5, 2, and 1; the tornal area in male dilated.

*Hab.* NIGERIA, Sapele (*Sampson*), 1 ♀ type, Warri (*Roth*); UGANDA, Kimmi I. (*Minchin*), 1 ♂; BR. E. AFRICA, Boiyuba (*Betton*), 1 ♂, 1 ♀. *Exp.* 20 mm.

(70 a) *Glyphodes triopis*, sp. n.

♂. Head and thorax white tinged with cupreous brown, the palpi white at base, cupreous brown at tips, the sides of head and thorax and tegulæ in front cupreous brown; fore



legs blackish above; abdomen white dorsally tinged with cupreous brown, the anal tuft black, brown at tip. Fore wing white, the costal area pale cupreous brown, the terminal area tinged with cupreous brown, the costal edge blackish; the base of cell cupreous brown defined by a blackish antemedial bar and with a minute brown antemedial ocellus below the cell; a brown ocellus defined by blackish in middle of cell, a similar elliptical discoidal spot and an elliptical spot below origin of vein 2; postmedial line brown, excurved from costa to vein 3, then incurved; a terminal series of black points; cilia whitish. Hind wing white; a small elliptical spot defined by brown on discocellulars; a sinuous brown postmedial line ending above tornus; the termen tinged with brown from apex to vein 2; a fine brown terminal line; cilia white.

*Hab.* N. GUINEA, Fak-fak (*Pratt*), 1 ♂ type. *Exp.* 28 mm.

(74 b) *Glyphodes phlebitis*, sp. n.

♀. Head, thorax, and abdomen white; palpi except at base, antennæ, and shoulders rufous; fore tibiæ rufous. Fore wing silvery white; the costa narrowly rufous; the veins slightly streaked with rufous, the curved vein 1 *a* rather more distinctly streaked; the termen tinged with brown; a fine brown terminal line; cilia tinged with brown at base. Hind wing silvery white, somewhat semihyaline; a fine brown terminal line; cilia tinged with brown at base from apex to vein 2. The underside with the termen of fore wing and of hind wing from apex to vein 2 suffused with brown.

*Hab.* S.E. Peru, La Oroya (*Ockenden*), 1 ♀ type. *Exp.* 38 mm.

(77 b) *Glyphodes atrisquamalis*, sp. n.

Head, thorax, and abdomen white; palpi black-brown except at base; sides of frons black-brown; fore tibiæ tinged with fuscous at extremity; abdomen with some black-brown irroration at sides of second and third segments and dorsally tinged with brown toward extremity. Fore wing semihyaline white irrorated with large black scales, except on basal area, where there are a few black scales below median nervure only; the costal area tinged with rufous; a small black spot in upper part of middle of cell and discoidal lunule; a diffused subterminal black line, excurved to vein 3, then incurved, slightly dentate towards costa; a terminal series of punctiform black striæ; cilia with slight

fuscous line near base. Hind wing hyaline white; a black point at lower angle of cell; a diffused fuscous subterminal line; a terminal series of black striæ; cilia with a slight fuscous line near base from apex to vein 2.

*Hab.* U.S.A., Arizona, Phoenix (*Kunzé*), 1 ♂, 1 ♀ type. *Exp.* 26 mm.

(77 c) *Glyphodes diplocyma*, sp. n.

♂. Head, thorax, and abdomen silvery white; palpi red-brown, white at base; sides of frons and shoulders red-brown; tibiæ and tarsi tinged with red-brown. Fore wing silvery white; the costal edge ochreous; the inner area with three faint oblique brown striæ on medial area; two faint waved brown subterminal lines with slight brown irroration beyond them; a fine terminal brown line with black points at the veins of apical half; cilia tinged with brown. Hind wing semihyaline silvery white; two faint brown subterminal lines, the inner waved, a series of faint brown spots beyond them before termen; a fine brown terminal line except towards tornus.

*Hab.* FRIENDLY Is., Vavau (*Eclipse Exp.*), 1 ♀ type. *Exp.* 42 mm.

(77 d) *Glyphodes irroratalis*, sp. n.

♀. Head and thorax white; palpi except at base, sides of frons and shoulders fulvous; fore femora at extremity and tibiæ on inner side brown; abdomen white tinged with fulvous except at base. Fore wing white thickly irrorated with large brown scales, the costa tinged with brown; a terminal series of black points; cilia brownish white with a brown line near base. Hind wing white irrorated with brown except basal and inner areas; a terminal series of black points; cilia brownish white with brown line near base.

*Hab.* BR. E. AFRICA, Eb Urru (*Betton*), 1 ♀ type. *Exp.* 28 mm.

(81 a) *Glyphodes argyritis*, sp. n.

Head, thorax, and abdomen brown with a slight silvery gloss; palpi darker, ochreous white at base; pectus ochreous white in front. Fore wing brown with a slight silvery gloss especially on the costa and cilia. Hind wing brown with a slight silvery gloss especially on the cilia, faintly semihyaline.

*Hab.* BR. N. GUINEA, Mafalu (*Pratt*), 3 ♂ type, Mt. Kebea (*Pratt*), 1 ♀. *Exp.* 40 mm.

(91 a) *Glyphodes pyritalis*, sp. n.

Bright pale green ; palpi fulvous except at base ; shoulders with fulvous stripes ; fore tibiæ pale fulvous ; anal tuft whitish and fuscous mixed. Fore wing with the costal edge narrowly pale fulvous ; traces of a dark discoidal point ; cilia green at base, white at tips. Hind wing with traces of a dark discoidal point ; cilia green at base, white at tips.

*Hab.* BR. E. AFRICA, Munisu (*Ld. Delamere*), 2 ♂, 1 ♀ type. *Exp.* 30 mm.

(91 b) *Glyphodes chlorophylalis*, sp. n.

Head, thorax, and abdomen bright yellow-green ; palpi rufous, white at base ; fore tibiæ with rufous bands at base and extremity, mid tibiæ rufous towards base, the tarsi tinged with rufous ; abdomen of male with large black-brown anal tuft with white bar before it, the ventral surface whitish. Fore wing bright yellow-green, the costal edge narrowly rufous ; a black discoidal point and terminal series of points ; cilia reddish brown. Hind wing bright yellow-green, the costal area whitish ; a black discoidal point ; the termen and cilia reddish brown.

*Hab.* BR. N. GUINEA, Ekeikei (*Pratt*), 2 ♂, 1 ♀, Mt. Kebca (*Pratt*), 3 ♂, 4 ♀ type. *Exp.*, ♂ 28, ♀ 30 mm.

(92 a) *Glyphodes prasinophila*, sp. n.

♂. Head, thorax, and abdomen yellow-green ; palpi with a few brownish hairs at extremity of second joint ; fore tibiæ fuscous with a whitish ring ; abdomen with the anal tuft pale brown, the ventral surface whitish. Fore wing yellow-green ; a slight blackish discoidal striga ; a terminal series of black points ; cilia whitish tinged with fuscous and with a dark line at base. Hind wing yellow-green ; a black discoidal point ; a terminal series of black points except towards tornus, forming striæ in submedian interspace ; cilia whitish tinged with fuscous and with a dark line at base.

*Hab.* TRANSVAAL, Nelspruit (*Cooke*), 1 ♂ type. *Exp.* 40 mm.

(94 a) *Glyphodes vernalis*, sp. n.

Pale green ; palpi fulvous except at base ; shoulders with slight fulvous stripes ; fore tibiæ tinged with fulvous ; anal tuft of male large, fuscous black mixed with silvery scales.

Fore wing with the costal edge pale fulvous; a black discoidal point; a terminal series of slight black points; cilia whitish. Hind wing with black discoidal point; cilia whitish.

*Hab.* NIGERIA, Old Calabar (*Crompton*), 1 ♂, 1 ♀ type. *Exp.* ♂ 22, ♀ 26 mm.

(94b) *Glyphodes chlorochroalis*, sp. n.

Bright green; palpi fulvous except at base; fore tibiæ banded with fulvous at base and extremity; anal tuft of male large, blackish mixed with silvery scales. Fore wing with the costa narrowly fulvous; a black discoidal spot; cilia brown at base, brownish white at tips. Hind wing with black discoidal point; cilia brown at base, brownish at tips.

*Hab.* NIGERIA, Old Calabar (*Crompton*), 1 ♀; CAMEROONS (*Sjöstedt*), 1 ♂ type. *Exp.*, ♂ 30, ♀ 34 mm.

(119b) *Glyphodes vagilinea*, sp. n.

♂. Head and tegulæ pale orange-yellow, the latter dorsally blackish at tips; thorax yellowish white, with a pair of blackish spots on prothorax and black spots at base of patagia; fore tibiæ with black band at tips, the tarsi banded with blackish; abdomen yellowish white, the third and fourth segments with brownish subdorsal spots, the anal tuft with black dorsal patch and lateral stripes. Fore wing pale yellow; a diffused blackish subbasal line; a curved blackish antemedial line connected by a short streak in submedian fold with the blackish postmedial line, which is obliquely incurved from costa to vein 3, then very strongly curved upwards to lower angle of cell and inwards to inner margin, at vein 3 connected with a subterminal line from vein 5, where it emits a streak to termen, to inner margin, slightly angled inwards at vein 3; the costa towards apex and the termen to vein 4 black. Hind wing semihyaline yellowish white; an oblique dark discoidal striga; an oblique striga below middle of vein 1; an oblique postmedial bar between veins 7 and 4; a subterminal line between veins 6 and 3 and an oblique striga across vein 2 with some orange-yellow at its upper extremity; a fine brown terminal line; cilia yellow at base, with a fine brown line at middle.

*Hab.* DUTCH N. GUINEA, Fak-fak (*Pratt*), 1 ♂ type. *Exp.* 30 mm.



(128 a) \* *Glyphodes bocchorialis*, sp. n.

♂. Ochreous white; palpi with the second joint above and at extremity black; vertex of head and thorax mixed with black; fore tibiae banded with black; abdomen with obscure blackish bands. Fore wing with almost basal, sub-basal, and antemedial fulvous yellow bands with sinuous black edges; a large fulvous yellow discoidal ocellus with black centre and black edges extending to costa; a black-edged fulvous yellow band, slightly excurved from vein 6 to below 2, then retracted to discoidal ocellus and bent outwards again to inner margin, connected with the antemedial band at vein 1 and with its own sinus, a white line on its outer edge from costa to vein 6 and some white spots between vein 5 and inner margin; the terminal area black; a subterminal series of irregular white spots conjoined towards apex; cilia black, yellow above and below middle. Hind wing with black-edged fulvous yellow discoidal spot connected by a black line with the inner margin towards which it forks; the terminal area black with irregular inner edge, a yellow spot on it between veins 3 and 5 and a subterminal series of irregular white marks, double towards apex; cilia yellow with a black line near base, black at apex, middle, and tornus.

*Hab.* STRAITS SETTLEMENTS, Padang Rengas. *Exp.* 16 mm. Type in Coll. Rothschild.

[To be continued.]

## LXVII.—On some Reptilian Lower Jaws.

By D. M. S. WATSON, M.Sc.

THE object of this paper is to describe the lower jaws of some fossil reptiles and amphibians of Permian and Triassic age from South Africa, and to discuss briefly the bearing of their structure on some morphological questions.

*Deinocephalia.*

The structure of the Deinocephalian lower jaw has been briefly described by Seeley (1896) and Broom (1910, 1911), but is not completely known. No known specimen shows the splenial or coronoid.

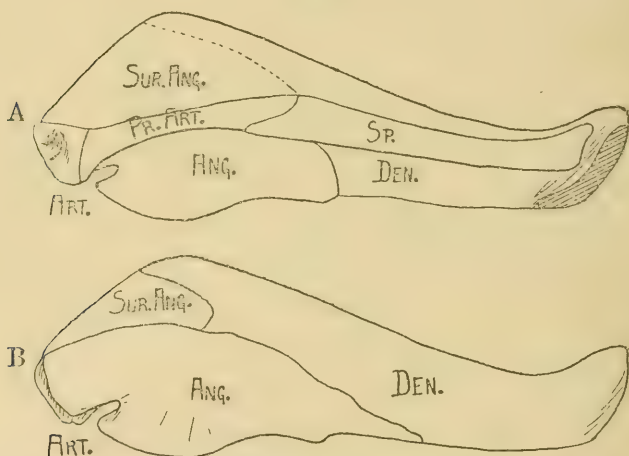
The outer aspect is very like that of *Dimetrodon*, and the

whole structure is very similar in the two types. The surangular and angular are flat bones overlapped by the dentary in front and covering the outer side of the small articular and the long prearticular. The articular has two cotyli for the double condyle of the quadrate, and has a small post-articular process which is directed backwards and slightly downwards.

*Pelycosauria.*

The lower jaw of *Dimetrodon* is now well known from the work of E. C. Case; its structure is shown in fig. 1, which is diagrammatized from his published figures and photographs, checked by specimens at Munich and Tübingen.

Fig. 1.



A. Left ramus of the lower jaw of *Dimetrodon*, inner aspect. B. Right ramus of the same jaw, outer aspect. Teeth omitted.  $\times \frac{1}{4}$ .

ANG., angular; ART., articular; CR., coronoid; DEN., dentary; PR.ART., prearticular, Williston, = dermarterial, Kingsley, = goniale, Gaupp; SP., splenial; SUR.ANG., surangular.

The large dentary meets its fellow in a loose symphysis, and at the back overlaps the surangular and angular. These latter are thin flat bones covering the outer faces of the articular and prearticular. The angular is remarkable for possessing a notch on the lower border towards the back; it will be shown in this paper that this notch more or less

modified occurs in all known types of Therapsids, and it occurs in no other reptiles whatever.

The splenial is a long narrow strip of bone lying on the inner side of the dentary, but not entering the symphysis. The coronoid has never been figured, but is said to be a narrow slip of bone, presumably lying inside the dentary over the splenial.

### *Anomodontia.*

The structure of the lower jaw of *Dicynodon* has been described by Owen and Broom. Seeley has described the lower jaw of *Endothiodon*, which has an essentially identical structure. None of these descriptions is complete or altogether accurate.

The present description is founded on a beautifully preserved lower jaw of a new species of *Dicynodon* (*Owlenodon* = female *Dicynodon*) from the *Cisticephalus*-zone of Kuils Poort, Beaufort West District, collected by the author. Several other jaws in the British Museum have been used for comparison, the sutures between the bones of the back of the jaw being best shown in a fragmentary jaw of *Kannemeyeria*\* collected by the author at Winnaarsbaaken, Burghersdorp District.

The dentary is a very powerful bone, uniting with its fellow in a median symphysis which completely closes even in quite young individuals. The posterior part of the bone is produced into two processes, the upper of which is split vertically into an inner and an outer plate, leaving between them a deep groove which receives the anterior ends of the surangular and angular.

The lower process, which is separated from the upper by a deep notch, forms only the outer surface of the same groove, the inner side being provided by the splenial.

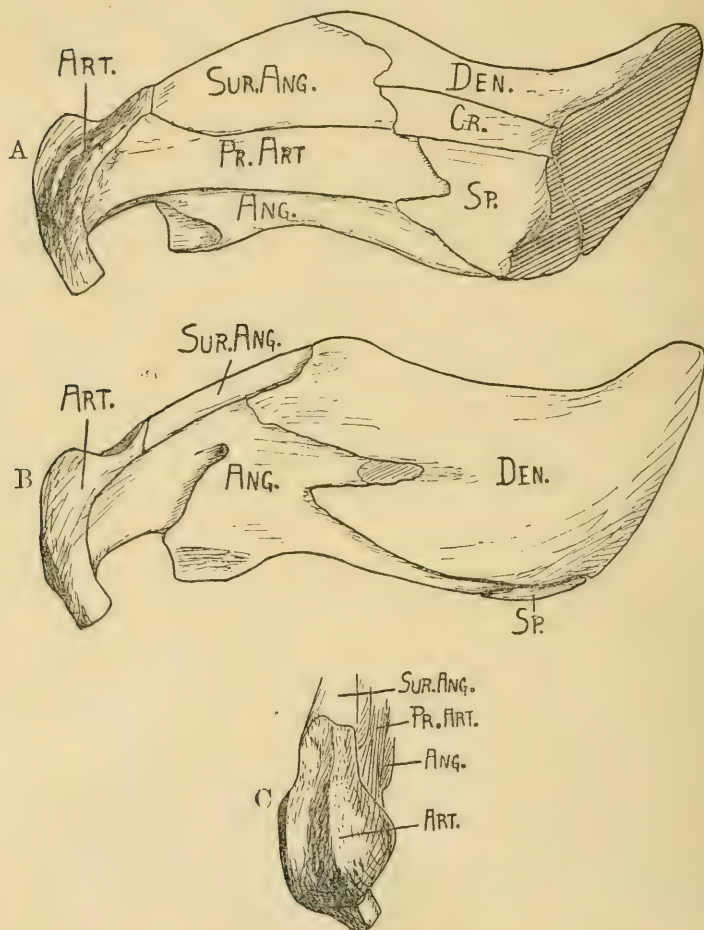
The splenial is a short bone, meeting its fellow in a very strong fused symphysis. Behind the region of the symphysis the bone is a thin plate, separated from the dentary by the groove already referred to, which in this region receives the angular and prearticular.

The coronoid is a thin slip of bone lying on the inner face of the dentary, separated from it and the splenial by very

\* *Kannemeyeria* is a genus founded by H. G. Seeley in 1908 on an imperfect skull of *Dicynodon simocephalus*, Weithofer. The genus is easily distinguished from *Dicynodon*, and I know three species belonging to it. The lower jaw does not differ from that of *Dicynodon*.

distinct sutures in several specimens, and apparently just entering the symphysis.

Fig. 2.



A. Left ramus of lower jaw of *Dicynodon*, inner aspect. B. Right ramus of the same jaw, outer aspect. C. Left articular region viewed from above and behind.  $\times \frac{1}{2}$ .

For key to reference-letters see fig. 1.

The surangular is a thin plate of bone whose upper edge is thickened so as to form a ridge on the outer surface, nearly



the whole of which is covered by the angular. Posteriorly it unites by a suture, which is very seldom visible, with the articular. A good deal of its inner surface is covered by the prearticular.

The angular is a very large bone, consisting essentially of a more or less flat plate tightly applied to the outer sides of the surangular and prearticular and separated above and behind by a suture from the surangular. Its anterior end is bevelled off to a point and received in the groove between the dentary and splenial. This plate is, however, modified by a great development of the notch mentioned above in *Dimetrodon*, protected and covered by a strong reflected lamina from the outer face of the bone, which forms a pocket open backwards. The body of the bone and the reflected lamina combine to form a deep descending flange on the lower border of the jaw.

The articular is perhaps the most characteristic bone of the whole skeleton of *Dicynodon*. Its articular face is directed upwards and backwards; it is throughout divided by a median keel which fits into a groove in the pulley-shaped quadrate. The anterior part of the articular face is shallowly concave and narrow from side to side; the concave region passes quite smoothly into a very convex (antero-posteriorly) surface, the sides of which are bounded by upstanding parapets, which render the bone much wider in this region; the outer of these is much the higher and clasps the side of the quadrate. Posteriorly the articulating face is bounded by a continuation of the edges of these parapets. The whole arrangement permits a great backward and forward motion of the jaw, together with an alteration of the angle which the upper surface of the dentary makes with the palate even when the mouth is closed.

The whole structure is quite unique, but very characteristic of Anomodonts, occurring as it does in a less pronounced form in *Endothiodon*.

The hinder end of the articular is continued into a post-articular process which is directed downwards and lies entirely in front of the hinder end of the articulating surface. It is still fairly large, and its flat posterior surface would afford good attachment to the digastric muscle. This process is continued forward by a ridge which forms a very narrow keel on the under surface of the body of the bone and is connected with the prearticular.

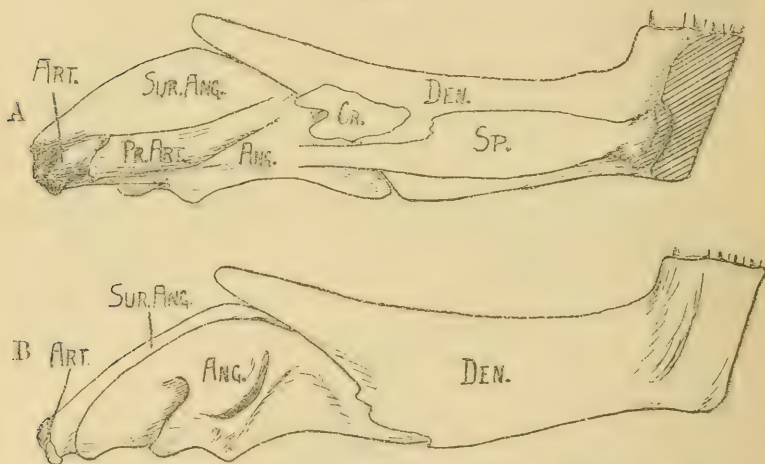
The prearticular is a long narrow bone, united by a suture, which is seldom visible, with the inner side of the keel on the under surface of the articular, and stretching forward on

the inner side of the surangular and angular until it passes inside the splenial nearly to its symphysis. The enormous development of this bone occurs in all Anomodonts, and is no doubt correlated with the great massiveness of the whole jaw.

### *Therocephalia.*

*Scymnosuchus whaitsi*, Broom, is taken as the type of the Therocephalia, of which it is a fairly primitive member. The material on which the description is founded consists of the two rami of the same lower jaw, the right of which has the bones naturally arranged and exposed from the outer side, whilst the left has the bones somewhat displaced, the back of the jaw being separated from the front; this jaw is free from matrix on all sides.

Fig. 3.



- A. Left ramus of lower jaw of *Scymnosuchus whaitsi*, inner aspect.  
 B. Right ramus of the same jaw, outer aspect. Teeth omitted.  
 $\times \frac{1}{2}$ .

The dentary is long and narrow, thick at the symphysis, where it is loosely articulated with its fellow, and thinning off posteriorly to an oblique feather-edge, which overlaps the surangular and angular. There is a large coronoid process which projects freely above the surangular.

The splenial is a thin strip of bone lying on the inner side of the dentary, and meeting the corresponding bone of the

opposite side in a relatively large symphysis. Its position in the figure may be slightly misplaced, being that which it now occupies in the somewhat disturbed jaw. The posterior narrow part of the bone is separated by a wide crack, and may conceivably be a somewhat misplaced part of the pre-articular.

The coronoid is a very thin bone whose shape is shown in the drawing lying on the inner aide of the dentary in the position shown.

The surangular is a very thin sheet of bone whose outer surface is almost entirely overlapped by the angular. Posteriorly it thickens and is united with the articular by a visible suture, its hinder edge overhanging the outer part of the articular facette.

The angular is a large thin bone overlapping the surangular and itself overlapped in front by the dentary. It is strengthened by a narrow rib which crosses its outer surface diagonally, and its lower border has a deep notch which is overhung by a reflected lamina exactly as in *Dicynodon*.

The articular is a small bone, triangular in shape when viewed from above, whose outer face is covered by the surangular. The base of the triangle is formed by the articular facette, which is directed backwards and very slightly upwards. The inner and lower faces of the bone are covered anteriorly by the prearticular. The lower side of the bone bears a very small and reduced postarticular process.

The prearticular is a long bone, flat anteriorly, but bearing a prominent ridge behind where it covers the articular, from which it is very obviously distinct in the specimen.

### *Cynodontia.*

The lower jaw of *Cynognathus* has been described by Seeley, whose description is, as usual, quite accurate, although hard to follow in the absence of intelligible figures. Most of his determinations of individual bones, although offered with great reserve, are also accurate. Broom has also described the type, but his reading of its structure is not quite correct.

The following account is founded on the perfectly preserved and prepared lower jaw of the type specimen of *Cynognathus crateronotus*, but I have compared it with all the other known specimens of higher Cynodonts.

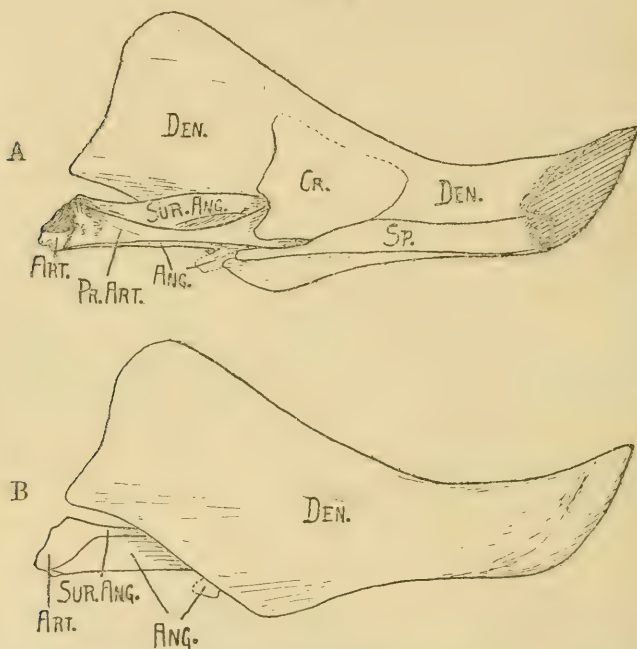
The dentary is a very large bone fused with its neighbour at the powerful symphysis, produced backward into an enormous coronoid process and overlapping all the other bones of the jaw.

The splenial is a narrow strip of bone lying on the inner side of the dentary and having a relatively large symphysis.

The coronoid is a large thin film of bone tightly pressed onto the inner side of the dentary and overlapping the surangular and prearticular at the back. It is remarkably similar to the corresponding bone in *Scymnosuchus*.

The surangular is a narrow sheet of bone whose outer surface is largely covered by the angular and dentary; its

Fig. 4.



A. Left ramus of lower jaw of *Cynognathus crateronotus*, inner aspect.

B. Right ramus of the same jaw, outer aspect. Teeth omitted.

$\times \frac{1}{4}$ .

inner face must be applied to the articular, but in no specimen is the suture between the two bones visible.

The angular is a plate of bone thickened below and covering a large part of the outer face of the surangular; its lower border has the usual notch placed very far forward and provided with a vestigial reflected lamina, not completely preserved in *Cynognathus*, but very well shown in *Diademodon*.

The articular is a small bone almost completely surrounded



by the others; the articular face points backwards and slightly upwards, and the downwardly directed postarticular process is a scarcely visible knob.

The prearticular is a long, thin, straight bone covering the inner side of the articular, from which it is separated by a scarcely visible suture. It lies inside the angular, and its forward end is covered by the coronoid.

It is a remarkable fact that in Cynodonts increasing size of the dentary, and of the masticatory muscles which in *Cynognathus* must be inserted on it, is correlated with a reduction and weakening of the back part of the jaw, which alone articulates with the skull; not only are the actual bones small, but their attachment to the dentary is weak, they merely rest in a groove in that bone and are often displaced in the fossil skulls. Examination of any higher Cynodont skull with the mandible in place will show that the very powerful masseter had its attachment on the dentary, and can scarcely have had any connection with the angular, and the temporal muscles were obviously inserted in mammalian fashion on the coronoid process of the dentary. The action of these powerful muscles must have set up such great stresses in the hinder part of the jaw that it is doubtful if it could have supported them. Directly correlated with increase in size of the dentary and reduction in size of the angular &c. is an increase of the descending process of the pterygoid. It is noteworthy that this takes place not only between the higher and lower Cynodonts, but also in the Therocephalian "*Lyco-saurus*" *currimola*, which pretty certainly comes from the *Cisticephalus*-zone of Upper Permian age. These processes give rise to the anterior part of the pterygoidal muscles, and their increase in size no doubt implies a corresponding increase in the muscles, which in reptiles are normally attached to the angular. As it is impossible that a muscle should increase whilst its point of attachment is degenerating, it appears probable that the pterygoidal muscles were mainly inserted onto the postero-inferior angle of the dentary, which is thickened. Thus inserted these muscles, whilst tending to close the mouth, will produce stresses in the hinder part of the jaw in the opposite direction to those induced by the masseter and temporal muscles, in this way permitting the reduction of the hinder part of the jaw which we actually see. The fact that in higher Cynodonts all the masticatory muscles have their attachments on the dentary renders the freeing of the articular and quadrate demanded by the quadrate=incus

theory of the mammalian ossicula auditus much more understandable.

The most marked characteristic of the Therapsid mandible is that it is no longer hollow and box-like, as in the Stegocephalia and the majority of the other reptiles, but that the bones of the inside of each ramus are tightly pressed against the outer bones, making it very narrow and solid. This feature (which is not very easy to describe) is eminently characteristic of the group and seems to occur in no other reptiles.

### *Pariasaurus.*

The lower jaw of *Pariasaurus* has been somewhat incompletely described by Seeley, but three jaws in the British Museum enable one to get a clear idea of the principal lines of its structure, although in one or two cases the sutures, shown dotted in the figures, are doubtful. The jaw is hollow, all the bones except the articular simply surrounding a cavity.

The dentaries meet in symphysis and pass backwards on the outer side of the jaw to overlap the angular and surangular; it is doubtful if the dentary ever reaches the lower border of the jaw—if it does so, it is only for a very small space just in advance of the angular. The wide tooth-bearing area of the dentary forms the roof of the cavity of the jaw.

The splenial is a bone having a large symphysis with its fellow of the opposite side; it certainly forms a good deal of the lower border of the jaw and apparently a good deal of its outer surface, but here the suture is not certain. On the inner aspect on each side the splenial is separated from the dentary by a narrow slit-like vacuity, which is bounded outwardly by the upper margin of the splenial rising rapidly to near the top of the jaw. Posteriorly the upper edge of the bone is separated from the dentary by the anterior part of coronoid, which is wedged in between the two bones. The hinder end of the splenial overlaps the prearticular and angular, forming also a small part of the border of the interior mandibular vacuity.

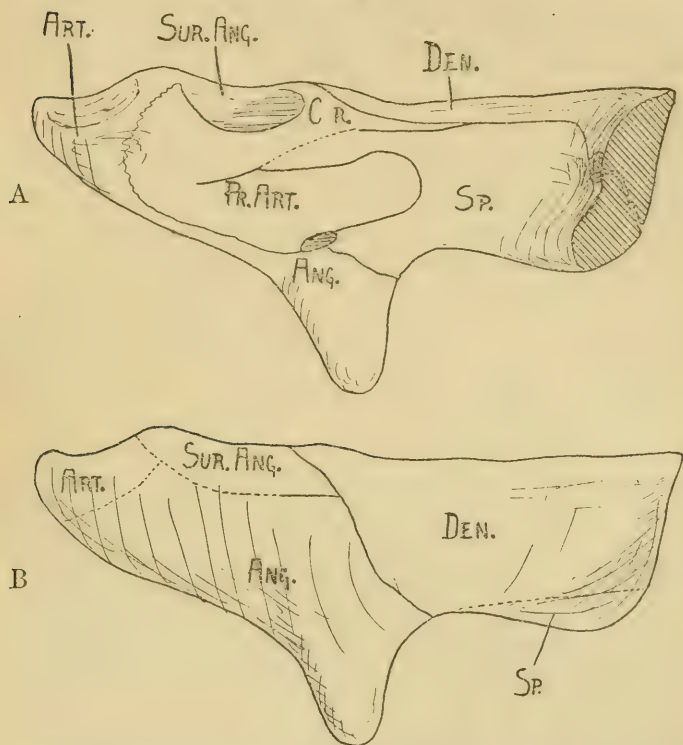
The coronoid is a small bone forming the front border of the supra-Meckelian vacuity, and prolonged forward by a thin strip which is wedged in between the splenial and dentary.

The surangular and angular are not separated by a satisfactory suture, but are overlapped anteriorly by the dentary and splenial, and form the outer and lower walls of the jaw;

the well-known process on the underside of the jaw is formed entirely by the angular, as Seeley thought.

The articular is a rather large bone fitting as a plug into the cavity of the back of the jaw, and extending rather far forward; its outer face is largely covered by the surangular

Fig. 5.



A. Left ramus of lower jaw of *Pariasaurus*, inner aspect. B. Right ramus of the same jaw, outer aspect. Teeth omitted.  $\times \frac{1}{4}$ .

and angular, and its inner side by the prearticular. The articular face has two cotyli for the condyles of the quadrate.

The prearticular is a large bone covering the inner face of the articular, overlapping the angular, and being itself covered by the splenial and coronoid in front.

There can be no doubt that the bones which in the preceding descriptions I have called by the same name are

homologous. It remains to show that they correspond with the bones which bear those names in *Crocodylus*, the standard animal for reptilian nomenclature. No doubt arises as to any of the bones except the splenial and coronoid. In all these types except *Dimetrodon* the splenial enters the symphysis and in some cases has a very large articulation with its fellow. In *Crocodylus* the splenial does not enter the symphysis, but in all Mesozoic crocodiles, in which there can be no doubt of its identity, it has a symphysis, sometimes a very large one. There is, in fact, no doubt that in all primitive reptiles the splenial takes a large part in the symphysis; it does so, for example, in Cotylosauria (*Pariasaurus*, *Limnoscelis*, *Diadectis*, *Labidosaurus*, *Captorhinus*, *Procolophon*), Therocephalia (all types examined), Cynodontia (all types examined), Anomodontia (all types), Sauropterygia (*Nothosaurus*, *Peloneustes*, *Pliosaurus*), Ichthyosauria (*Ichthyosaurus*, *Ophthalmosaurus*), "Rhynchocephalia" (*Rhynchosaurus*, *Hyperodapedon*?, *Champosaurus*), Thecodontia (*Belodon*, *Mystriosuchus*), Crocodilia (*Mystriosaurus*, *Stenoeosaurus*, *Metriorhynchus*)—a list which might be extended indefinitely.

The identity of the coronoid is not quite so obvious, owing to the fact that it frequently extends far forward, in *Dicynodon* probably reaching the symphysis. In the living crocodiles it is a very small bone forming the front of the supra-Meckelian vacuity. In *Metriorhynchus*, however, as has been described by Deslongchamps and as Dr. Andrews has demonstrated it to me, it is a long bone stretching far forward between the splenial and dentary, much as in *Pariasaurus*. In *Peloneustes* Dr. Andrews has shown that the coronoid, which has exactly the same relations as in *Metriorhynchus*, may extend forward to the symphysis, and does extend far forward in all Plesiosaurs.

These facts seem to me to justify the terminology of this paper; it is, however, interesting to examine a Stegocephalian jaw in the light of them. The Stegocephalian mandible is best known from the work of Branson on *Anaschisma* and *Eryops*, checked and accepted for *Eryops* by Case, and supported by Seeley's description of the hinder part of the lower jaw of "*Labyrinthodon*" *lavisii* and Smith Woodward's of the mandible of "*Labyrinthodon*" *leptognathus*.

These descriptions, when compared with the less well-known mandibles of other types, go far to show that the plan of structure is the same in all *Temnospondylus* and *Stereospondylus* Stegocephalia.

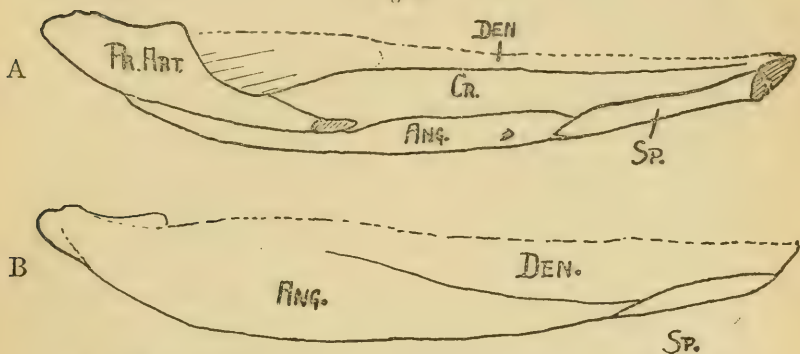
*Bothriceps* is a small *Temnospondylus* Stegocephalian of



Upper Permian age from the Orange Free State, South Africa; the excellent series of specimens in the British Museum show all points of the structure of the mandible with great clearness, except the upper edge, which in all cases is obscured by the skull.

The dentary is a long shallow bone meeting its fellow in a loose suture and extending backwards on the outside of the jaw until it meets the angular and surangular: it never reaches the lower border of the mandible.

Fig. 6.



A. Left ramus of lower jaw of *Bothriceps*, inner aspect. B. Right ramus of the same jaw, outer aspect. Teeth omitted.  $\times 1$ .

The splenial is the bone figured by Branson in *Anaschisma* and *Eryops* without determination and with some doubt. It was clearly figured by Smith Woodward in *Labyrinthodon leptognathus*, and called infra-dentary by analogy with the bones of that name in the Crossopterygian jaw; the homology implied by this nomenclature is no doubt correct.

In *Bothriceps* it is a small element with a large symphysis, forming the lower border of the anterior part of the jaw; posteriorly it meets and overlaps the angular.

Dr. A. S. Woodward, in his account of the *Labyrinthodon* jaw, described a little slit on the inside of the jaw lying on each side of the symphysis, bounded by the "infra-dentary" below and the dentary above. These little vacuities also occur in the type specimens of *Rhinesuchus oweni* (Lydd.) and *Rhytidosteus africanus*, Owen, and no doubt generally in the group. They correspond exactly with the similarly placed openings in *Pariasaurus* described above, and are clearly shown in Williston's figure of *Casea* and Williston and Case on *Diadectes lentus*.

The coronoid is the bone usually described as splenial in the Stegocephalian mandible; it is a long strip of bone lying on the inside of the jaw and overlapped by the splenial and angular; behind, it forms a good deal of the lower border of the supra-Meckelian vacuity, overlaps the prearticular, and forms the anterior border of the small interior mandibular vacuity. It cannot be seen in *Bothriceps* whether it enters the symphysis, but as it does not in any other known amphibian, including *Trimerorachis* (which is nearly identical with *Bothriceps*), it probably does not in *Bothriceps*.

In *Eryops*, *Anaschisma*, and *Labyrinthodon* this bone forms a parapet on the inner side of the tooth-bearing area of the dentary.

I have pointed out above that in all early reptiles the splenial is a bone of the mandibular symphysis, and that in its appearance and relations it is identical with the "infra-dentary" of Stegocephalia. The so-called "splenial" of Stegocephs is equally similar to the coronoid of such forms as *Pariasaurus*, *Peloneustes*, and *Metriorhynchus*, in which it is a long narrow splint bordering the tooth-bearing area of the hinder part of the dentary, and overlapped below by the splenial; in *Peloneustes* and probably *Dicynodon* the coronoid actually reaches the symphysis, so that the great forward extension of the "splenial" of Stegocephalia cannot be advanced against this correlation.

The only sound piece of evidence against this interpretation is the occurrence, recorded by Branson, of a small coronoid-like bone lying between the "splenial" and the dentary in front of the supra-Meckelian opening in *Anaschisma* and *Eryops*. It seems to me easier to regard this bone, for which I propose the name epicoronoid, as having disappeared in the reptilian jaw, than to imagine that it should secondarily acquire a forward extension, that the "splenial" should extend forward and gain a symphysis, and downwards by the disappearance of the "infra-dentary" to form the lower border of the jaw, completely mimicking in the appearance of its anterior part the "infra-dentary" which it displaced.

As Smith Woodward has pointed out, the bone here regarded as splenial in the Stegocephalia is apparently homologous with the first or one of the infra-dentaries of the Crossopterygian mandible. The true coronoid will be homologous with the "splenial" of the fish, and Branson's "coronoid" in *Anaschisma* may correspond to the last of the little bones which in *Holoptychius* and all allied fish lie between the dentary and the "splenial."

I wish to express my thanks to the Trustees of the Percy Sladen Fund, who assisted me to visit South Africa; to Messrs. J. Strydom and M. de Jager, on whose farms I found some of the specimens described above; to the Rev. J. H. Whaits, to whom the British Museum owes the *Scymnosuchus*; and to Drs. A. Smith Woodward and C. W. Andrews, for their constant kindness at the Museum.

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## LXVIII.—Two new Races of Mongoose.

By OLDFIELD THOMAS.

(Published by permission of the Trustees of the British Museum.)

*Mungos paludinosus mordax*, subsp. n.

Size very large, the skull larger than in any example of *M. p. robustus*. Frontal region unusually convex, the outline strongly bowed. Crest well developed. Posterior palatal tube of medium breadth. Bullæ well inflated.

Teeth exceedingly large and heavy, far surpassing those of any other member of the group (see measurements below). Small anterior premolar absent as usual, this tooth being only present in the western race of the species, *M. paludinosus pluto*, Temm.

Dimensions of skull :—

Candylo-basal length 115 mm. ; zygomatic breadth 63·4 ; breadth of nasal opening 12·6 ; interorbital breadth 23·5 ; intertemporal breadth 11·3 ; palatal length 66 ; palate breadth outside  $p^4$  39·4 ; outer breadth of posterior palatal tube 10·6.

*Teeth*.—Combined breadth of upper incisors 15·2 ;  $p^3$  8·5 × 7·1 ;  $p^4$ , greatest diameter 14·5, length on outer side 11·7 ;  $m^1$ , transverse diameter 12·5 ;  $m^2$  7·5 × 3·7 ;  $m_1$  11·7 × 7·1 ;  $m_2$  6·8 × 5·6.

*Hab.* Rombashi River, in German E. Africa, N.W. of the north end of Lake Nyasa. Alt. 1600'.

*Type.* Adult skull with unworn teeth ; said to be female, but more probably male. B.M. no. 3. 2. 16. 2. Collected in November 1888, and presented by Capt. R. Crawshay.

The conspicuously greater size of the teeth will readily distinguish this fine mongoose from its allies *M. p. robustus* and *rubellus*. Hollister's *M. p. rubescens*\* from Kilimanjaro is decidedly smaller.

*Mungos naso nigerianus*, subsp. n.

Essential characters as in true *naso*, but size markedly smaller.

Colour as in *naso*.

Skull smaller in all dimensions, as indicated by the dimensions below. Frontal region rather less convex. Bullæ much smaller.

\* P. Biol. Soc. Wash. xxv. p. 1 (1912).



External dimensions as recorded by collector:—

Head and body 534 mm.; tail 361; hind foot 98; ear 33.

Skull: condylo-basal length 101; zygomatic breadth 53·5; interorbital breadth 20·5; intertemporal breadth 17·5; palatal length 55; breadth between outer sides of  $p^4$  33; length of bullæ 19; breadth between outer surfaces of bullæ 38·5. Length of  $p^4$  on outer edge 9·8.

*Hab.* Niaji, 20 miles N.E. of Oban, Southern Nigeria. Another specimen without skull from Oban.

*Type.* Adult female. B.M. no. 10. 6. 1. 14. Original number 20. Collected 17th October, 1909, by P. A. Talbot, Esq.

The Museum now possesses six skulls of *M. naso* from different localities in the Cameroons, and these are so uniformly larger than Mr. Talbot's specimen that I only hesitate as to whether the latter ought not to be referred to a different species. The difference in the size and lateral extension of the bullæ is especially noticeable.

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LXIX.—On new Mammals from the Islands of the Johore Archipelago, South China Sea. By HERBERT C. ROBINSON, C.M.Z.S.

*Crocidura klossii*, nom. nov.

*Crocidura major*, Kloss (Wagler), Ann. & Mag. Nat. Hist. (8) vii. p. 117 (1911); id. Journ. Fed. Malay States Mus. iv. pp. 194, 195 (1911).

Mr. G. S. Miller has pointed out to me that Mr. Kloss's name for this shrew from Great Redang Island is antedated by *Crocidura major*, Wagler, Isis, p. 1218 (1832), a synonym of *Crocidura russula*, and I therefore substitute the above name for it.

*Crocidura aoris*, sp. n.

*Type.*—Adult female (skin and skull), No. 166/12, Selangor Museum, collected at Batu Berhala, Pulau Aor, Johore Archipelago, South China Sea, 13th June, 1912, by H. C. Robinson and E. Seimund. Original no. 4859.

*Characters.*—A large member of the subgenus *Crocidura*, slightly larger than *C. klossi*, but very distinctly paler above and with a marked liver-brown coloration on the breast and anterior portion of the abdomen.

*Ann. & Mag. N. Hist. Ser. 8. Vol. x. 40*

*Colour*.—Above silvery grey, somewhat darker on the muzzle, feet, hands, and lower portion of the back, the base of the fur very slightly lighter. General colour beneath similar but paler on the throat, pelage of the chest and upper abdomen with a very decided wash of liver-brown. Tail very finely annulated, dull black, above and below, furnished with a few long whitish hairs towards the base. Vibrissæ silvery grey, blackish at the extreme base. No lateral scent-glands in the only specimen (female) available.

*Skull and teeth*.—The skull very closely resembles that of *C. klossii*, but the interpterygoid space is narrower and more parallel-sided and the molar series, viewed from above, are less divergent and more parallel, so that the palate appears narrower in proportion to its length than is the case with *C. klossii*.

*Measurements*.—Collectors' external measurements (taken in the flesh):—

Head and body 102 (97\*) mm.; tail 78 (69); hind foot 16 (16); ear 11 (10·6).

Skull: greatest length (excl. incisors) 23·8 (23·0); basal length 21·1 (20·9); palatal length 10·3 (10·0); lachrymal breadth of rostrum 4·9 (4·7); greatest breadth above molars 7·9 (7·8); cranial breadth above mastoid 10·5 (10·5); maxillary tooth-row, including incisors, 11·0 (10·8); mandibular tooth-row (including incisors) 10·0 (10·0).

*Specimens examined*.—One, the type.

*Remarks*.—The species seems closely allied to *C. lepidura* † from East Sumatra, though that form has apparently a longer foot and, relatively to the breadth of skull above the posterior molars, a rather longer muzzle. The skull of the only specimen known is, however, very imperfect.

*Atherurus macrourus pemangilis*, subsp. n.

*Type*.—Adult female (skin and skull), No. 341/12, Selangor Museum, collected on Pulau Pemanggil between Pulau Aor and Pulau Tioman, Johore Archipelago, South China Sea, 16th June, 1912, by Museum collectors. Original no. 5014.

*Characters*.—A race of the mainland *A. macrourus* (Linn.), differing in its very much smaller size. Separated from *A. m. tionis* ‡, of Tioman, by its shorter nasals and deeper

\* Measurements in parentheses those of the type of *C. klossii*.

† Proc. U.S. Nat. Mus. xxxiv, p. 662 (1908).

‡ Thomas, Journ. Fed. Malay States Mus. ii, p. 105 (1908):

muzzle, and from *A. m. zygomaticus* \*, of Aor, by the large size of the lachrymal and by the absence of the tooth-like process on the under side of the malar.

*Colour*.—Somewhat darker than either *A. m. macrourus* or *A. m. tionis*, closely resembling *A. m. zygomaticus*.

*Skull*.—Quite distinct from that of its nearest geographical neighbour, *A. m. zygomaticus*, in that the lachrymal is distinctly visible when the skull is viewed from above, the zygomatic arch much narrower, and the tooth-like process of the malar not even indicated. Intertemporal constriction less marked than in the mainland form, the nasals shorter than in that from Tioman, the muzzle being also deeper and the posterior portion of the frontals more inflated. Fronto-premaxillary suture in advance of the posterior termination of the nasals and not in line with it as in the two related forms.

*Measurements*.—Collectors' external measurements of type (taken in the flesh):—

Head and body 456 (516 †) mm.; tail — (176); hind foot 64 (60); ear 35 (34).

Cranial measurements: upper length 89 (91); condylo-basilar length 75 (77); greatest breadth 45 (48); nasals  $24.5 \times 13$  ( $27 \times 15$ ); intertemporal breadth 24.3 (26); height of muzzle on diastema 20.8 (18.5); height of crown above palate 24.2 (25); palatilar length 35 (39); diastema 23.2 (28); length of upper tooth-row (crowns) 16.3 (16.8).

The dimensions of an adult male are:—

Head and body 490 (586 †) mm.; tail 180 (304); hind foot 64 (73); ear 36 (38).

Cranial measurements: upper length 89.5 (102); condylo-basilar length — (94); greatest breadth — (51); nasals  $24.5 \times 14.5$  ( $26.9 \times 15$ ); intertemporal breadth — (27); height of muzzle on diastema 21 (22); height of crown above palate — (27.8); palatilar length — (43.5); diastema 28.5 (31.8); length of upper tooth-row (crowns) 16.1 (17.0).

*Specimens examined*.—Four, all from the type locality.

*Remarks*.—Exceedingly abundant among the rocks on the

\* Miller, Smithsonian Misc. Coll. 45, p. 42, pl. ii. fig. 4 (1903); Lyon, Proc. U.S. Nat. Mus. xxxii, pp. 587, 588, 593 (1907).

† Measurements in parentheses those of the type of *Atherurus tionis*.

‡ Measurements in parentheses those of an adult male *Atherurus macrourus* from Sungei Siput, Central Perak, Selangor Museum, No. 966/11.

higher portions of Pulau Pemanggil, this porcupine is more closely allied to the form from Tioman than it is to that of Aor, though in the case of the other species inhabiting Pemanggil their affinities are rather with those of the latter island.

*Sciurus vittatus famulus*, subsp. n.

*Type*.—Adult male (skin and skull), No. 153/12, Selangor Museum, collected on Pulau Dayang, near Pulau Aor, Johore Archipelago, South China Sea, June 16th, 1912, by H. C. Robinson and E. Seimund. Original no. 4938.

*Characters*.—A dwarfed form of the *vittatus* group, closely approximating in size to its geographical neighbour *Sc. v. aoris*, Miller, but in colour intermediate between that form and *Sc. v. peninsularis* from the mainland of Johore and Singapore Island. Skull: greatest length (mean of ten specimens) 44·7, zygomatic breadth 26·0, against 49·4 and 28·0 in the type of *Sc. v. peninsularis*.

*Colour*.—Upper parts a fine grizzle of black and buffy olivaceous, less greyish than in *Sc. v. aoris* and less rufescent than in *Sc. v. peninsularis*. Feet and hands grizzled black and golden buff, the latter in excess. Cheeks grizzled greyish buff; a buff eye-ring. Buffy-white side-stripe broader and not quite so clearly defined as in *Sc. v. peninsularis*, but the black stripe shorter and narrower and not so dark, but still sharply defined and not largely obscured by grizzling as in many specimens of *Sc. v. aoris*. Tail like back, but annulations more pronounced and with the terminal portion strongly washed with ochraceous rufous, a tint entirely absent in *Sc. v. aoris*. Under surface ochraceous rufous, rather less ochraceous than in *Sc. v. peninsularis*, but not nearly so buffy as in *Sc. v. aoris*. Throat, upper chest, and under surface of fore limbs golden buff.

*Measurements*.—Collectors' external measurements (taken in the flesh):—

Head and body 176 (199\*) mm.; tail 158 (198); hind foot 40 (47·5); ear 16·5 (16).

Cranial measurements: greatest length 45·1 (51·2); condylo-basilar length 38·8 (43·1); interorbital breadth 16·2 (18·1); zygomatic breadth 26·0 (29·8); cranial breadth 20·8 (23·2); median length of nasals 13·1 (15·4); diastema 10·3 (11·1); upper molar series, including  $pm^3$ , 8·3 (9·6).

*Specimens examined*.—Ten, all from the type locality.

\* Measurements in parentheses those of an adult male *Sciurus v. peninsularis* from Changi, Singapore Island, Selangor Museum, No. 1743/08.



*Remarks.*—Though Pulau Dayang is separated from Pulau Aor by a channel which is little more than a quarter of a mile wide, there is a minimum depth of twenty-five fathoms between the two islands, and it is unlikely that any inter-communication can take place between the races of squirrels and rats found on either side of the strait. The ten specimens from Pulau Dayang when mixed with thirty from Pulau Aor can be picked out without the slightest difficulty by any person able to appreciate marked differences in tint. The affinities of the present form and *Sc. v. tenuirostris* inhabiting Tioman are decidedly with the mainland races, while those of *Sc. c. aoris* and *Sc. v. pemangilensis* are rather with those inhabiting the Natunas and Anambas.

*Epimys surifer pemangilis*, subsp. n.

*Type.*—Adult male (skin and skull), No. 447/12, Selangor Museum, collected on Pulau Pemanggil, Johore Archipelago, South China Sea, 16th June, 1912, by Museum Collectors. No. 4999.

*Characters.*—In size about equal to *E. s. grandis* and *E. s. flavigrandis*\* (Kloss), but much brighter in colour than either of these races, young and unabraded specimens approaching *E. s. leonis*† from Singapore in clearness of tint.

*Colour.*—Upper parts ochraceous orange, brightest on the flanks, nape, and limbs, darkened on the shoulders, back, and rump with the brown tips of the spines. Upper part of the head, muzzle, and patches round the eyes earthy brown. Cheeks and sides of the head pale yellowish buff, not whitish at the base of the vibrissæ, which are dark brown, paler at the tips. Hands and feet whitish, without darker stripe, sharply defined in the case of the feet from the colour of the limbs. Beneath white, this colour continued as an ill-defined stripe on the outer side of the leg and the inner side of the arms to the ankles and wrists. Tail black above and at the tip, whitish beneath.

*Skull and teeth.*—Skull stout and heavily built as in *E. s. grandis* and *E. s. flavigrandis*, but with the rostrum rather more slender and the nasals narrower than in these races. Anterior edge of infraorbital plate sloping slightly forwards. Palatal foramina rather longer and broader and bullæ smaller and flatter than in any of the other forms. Teeth with no differential characters.

\* Ann. & Mag. Nat. Hist. (8) vii. p. 119 (1911); Journ. Fed. Malay States Mus. iv. pp. 209–211 (1911).

† Journ. Fed. Malay States Mus. iv. p. 170 (1911).

*Measurements.*—Collectors' external measurements of type (taken in the flesh):—

Head and body 220 (208\*) mm.; tail 175 (180); hind foot 42 (43); ear — (23).

Cranial measurements: greatest length 48·0 (48·0); basal length 42·3 (42); palatal length 22·2 (22); length of nasals 19·0 (20·7); greatest breadth of combined nasals 4·9 (5·3); shortest distance between tips of nasals and lachrymal notch 19·8 (19·2); diastema 14·0 (14·0); upper molar row 7·1 (7·4); length of palatal foramina 7·9 (7·0); breadth of combined foramina 4·1 (3·9); zygomatic breadth 20·9 (21·5); cranial breadth 17·0 (17·2); depth of rostrum at anterior extremity of palatal foramina 9·0 (9·1); breadth of rostrum midway between henselion and palatal foramina 6·3 (7·4).

*Specimens examined.*—Thirteen skins and skulls and one additional skull, all from the type locality.

*Remarks.*—From *E. surifer microdon*† (Kloss) from Tioman this race differs mainly in its more heavily built skull, the teeth not reduced in size, and in the absence of a buff gorget across the throat. In *E. s. microdon* also the white of the under surface is, as a rule, broadly separated from the ankles by the buff of the thighs.

*Epimys surifer aoris*, subsp. n.

*Type.*—Adult male (skin and skull), No. 445/12, Selangor Museum, collected on Pulau Aor, Johore Archipelago, South China Sea, 15th June, 1912, by H. C. Robinson and E. Seimund. Original no. 4947.

*Characters.*—Very similar to the preceding race and with a similarly robust skull, but colour decidedly less intense. Head rather darker. Anterior margin of infraorbital plate almost vertical; nasals broader, the anterior margin much less receding.

*Colour.*—Mingled black and ochraceous buff, hardly brighter on the flanks than elsewhere, but pelage of all the adult specimens somewhat abraded. Top of head, muzzle, and patches round the eyes darker brown than in the allied forms. No whitish patch at the roots of the vibrissæ. White of the under surface continued as a more or less ill-defined line to the wrists and ankles.

*Skull and teeth.*—Skull generally similar to that of *E. s. pemangilis*, with the differences noted above. Outline

\* Measurements in parentheses those of the type of *Mus surifer flavigrandis*.

† Journ. Fed. Malay States Mus. ii. p. 145 (1908).

of cranium, viewed from above, rather more rounded, the fronto-parietal ridge less sharply deflected at the suture. Nasals broader and much less sharply cut away at the anterior extremity. Teeth similar to those of *E. s. pemangilis*.

*Measurements*.—Collectors' external measurements (taken in the flesh):—

Head and body 214 (204\*) mm.; tail 185 (188); hind foot 41 (42); ear 22 (23).

Cranial measurements: greatest length 47.8 (49); basal length 42.0 (41.7); length of nasals 17.4 (19.8); greatest breadth of nasals 5.8 (5.6); shortest distance between tips of nasals and lachrymal notch 19.0 (20.4); palatal length 22.3 (22); diastema 13.9 (13.4); length of palatal foramina 7.1 (6.9); breadth of combined palatal foramina 4.1 (3.9); zygomatic breadth 21.2 (21); cranial breadth 17.3 (17.2); depth of rostrum at anterior extremity of palatal foramina 8.9 (9.3); breadth of rostrum midway between henselion and palatal foramina 7.1 (8.0); upper molar row 7.2 (7.5).

*Specimens examined*.—Fifteen skins and skulls and one additional skull, all from the type locality.

*Remarks*.—This race can be readily separated from the adjacent *E. s. pemangilis* by its duller coloration and by the shorter and less acuminate nasals, which seem a fairly constant feature.

LXX.—*Eight New Fishes from Baluchistan*. By Dr. ERICH ZUGMAYER, of the Zoological Museum, Munich.

AMONG a collection of marine and freshwater fishes which I made during a journey along the Mekran coast and in the interior of Baluchistan the following appear to be new.

I. MARINE FISHES.

*Platycephalus platysoma*, sp. n.

Distinct from all other species by its strongly depressed body, whose depth is less than  $\frac{1}{12}$  of the total length. Length of head a little over  $3\frac{1}{2}$  in total length, breadth of head  $4\frac{3}{4}$  in the same. Interorbital space flat, equal to 2 diameters of

\* Measurements in parentheses are those of the type of *Mus surifer grandis*.

eye, snout  $2\frac{1}{2}$ , length of head 9; two strong preopercular spines. Lateral line unarmed.

D. I/8 13, P. 19, V. 6, A. 13, C. 14.

Uniform reddish brown, spines and rays of dorsal with rows of black spots. Caudal yellow, with an oblique black bar in its lower and two oblong black blotches in its upper half.

One specimen, 570 mm. long, from Gwadar.

[A Pleuronectid from Gwadar answers in every respect to the description of *Pseudorhombus russellii*, Gray, except that the gill-membranes, which should be united to the isthmus, are free to the chin.

In 'Zool. Anzeiger,' vol. xxxix. no. 21/22, Mr. R. Engelhardt has, under the name of *Torpedo zugmayeri*, described a new electric ray, which I found at Gwadar.—E. Z.]

## II. FRESHWATER FISHES.

*Scaphiodon watsoni*, Day, var. *belense*, var. n.

D. IV/9-10, P. 15-16, V. 8, A. II/7, ll. 33-36, lt. 7/6,  
dph. 4-3-2-2-3-4.

Length of head  $5\frac{1}{2}$ , height of body a little less than 3 in total length. Diameter of orbit 6 in length of head. Last undivided dorsal ray strong, osseous and serrated to the tip; pectoral almost as long as head. Coloration bluish on back, sides yellow, abdomen white; fins pale.

This variety is distinguished from the typical species by its longer pectoral, greater depth of body, shorter head, and much smaller eyes.

Forty-two specimens, up to 230 mm., from the Purali River, near Las Bela.

*Scaphiodon daukesi*, sp. n.

D. III/10-11, P. 18, V. 8, A. II/7, ll. 38-39, lt. 8/6-8/7,  
dph. 4-3-2-2-3-4.

Length of head  $3\frac{1}{2}$ -4 in total length, depth of body  $4\frac{6}{10}$  to  $4\frac{7}{10}$ ; orbit 5 in length of head, twice in interorbital space. Barbels 2, shorter than the eye. Lower jaw with a very thin horny covering, without sharp margin. Mouth terminal,



large and broad, lips fleshy, snout with glandular pores and warts and a groove across it. Dorsal arises slightly ahead of ventrals, its last undivided ray moderately strong, serrated nearly to the tip. Scales regular on sides and back, small and hardly touching each other on the abdomen. None of the fins reaches the next. Caudal moderately forked, the lower lobe the longer.

Coloration dark olive above, silverish yellow on sides, white on lower surface. Orange blotches in both sexes on preopercle, base of pectoral, and along the lateral line; fins yellowish.

Distinguished from *Sc. baluchiorum*, Jenkins, by the size and position of the mouth, greater size of eye, and greater length of head; from *Sc. macmahoni*, T. Reg., by the same characteristics and the comparatively smaller depth of body.

Ten specimens, from 110 to 190 mm., were caught in irrigation channels and pools near Panjgur.

*Labeo macmahoni*, sp. n.

D. III/8, P. 17, V. 10, A. II/5, C. 22, ll. 35-36. lt.  $\frac{5\frac{1}{2}}{6\frac{1}{2}}$ ,  
ll.-v.  $4\frac{1}{2}$ , dph. 5-4-2-2-4-5.

Length of head  $5\frac{1}{2}$ , depth of body  $4\frac{1}{2}$  in total length. Diameter of orbit 4 in head,  $2\frac{1}{2}$  in interorbital space, and  $1\frac{2}{5}$  in snout. Mouth very soft and flabby, with pronounced lateral lobes. Jaws closely enveloped by lips; a median transverse fold to lower lip, two external folds. Lower jaw with a hard and sharp horny margin. Barbels four: two rostral, shorter than the eye, two very small ones in the corners of the mouth. Dorsal arises midway between tip of snout and end of base of anal fin, considerably before the origin of ventrals; pectoral reaches  $\frac{2}{3}$  towards ventral, the latter  $\frac{3}{4}$  towards anal.

Slate-blue on back, golden and silvery on sides and abdomen; no marks; fins pale, unspotted.

None of the other Asiatic species combines the low number of dorsal rays with the presence of 4 barbels.

Thirteen specimens from Dasht River, near Suntsar and Turbat; this seems the westernmost habitat of the genus in Asia.

*Labeo gedrosicus*, sp. n.

Five specimens, 300–345 mm., from Panjgur.

D. III/10, P. 14, V. 9, A. II/6–7, ll. 42, lt.  $\frac{8}{9}$ , ll.-v.  $7\frac{1}{2}$ ,  
dph. 5–4–2–2–4–5.

Length of head  $5\frac{1}{2}$ , depth of body not quite 5 in total length. Breadth of head  $\frac{7}{10}$  of its height, height  $\frac{5}{6}$  of its length. Snout a little over  $\frac{1}{3}$  of length of head. Eye at the end of the first half of length of head, diameter 7–8 in head, 3 in interorbital space. Lips continuous, the lower only fringed; median, transverse, and lateral folds to lower lip. The lower jaw only with a horny covering and margin; no lateral lobe to snout, a groove across the latter; glandular pores present. Barbels two, hidden in lateral grooves. Dorsal arises over end of pectoral, considerably before ventral. Last undivided dorsal ray articulate, slightly longer than head; margin of dorsal strongly concave, the shortest rays being  $\frac{2}{3}$  of the longest. Pectoral nearly as long as head and reaching  $\frac{5}{7}$  towards ventral; the latter measures  $\frac{9}{10}$  of pectoral and reaches  $\frac{5}{7}$  towards anal; anal  $\frac{5}{7}$  towards root of caudal. Length of caudal, which is deeply forked, equal to depth of body.

Greyish brown, bluish on back, fins pale; a golden spot on preopercle, anterior margin of dorsal black.

Allied to *L. diplostomus* (Heck.), which occurs at the same locality, but distinguished by its smaller eyes, the median fold to the lower lip, and the covering of the jaws, which here is found on the lower jaw only. Moreover the dorsal arises midway between snout and beginning (not end) of base of anal.

*Nemachilus brahui*, sp. n.

D. 9, P. 11, V. 8, A. 7, C. 18.

Head 5, depth of body  $6\frac{1}{2}$  in total length. Depth of head  $\frac{6}{7}$  of its breadth, breadth  $1\frac{2}{3}$  in its length. Diameter of orbit  $\frac{1}{8}$  of length of head,  $\frac{3}{7}$  of interorbital space. Snout as long as postorbital portion of head. Cleft of mouth does not extend to below the anterior nostril. Lips thick, papillose, the lower interrupted. Barbels six, the outer rostral, which is the longest, reaching to posterior nostril. No scales. Dorsal arises midway between anterior margin of orbit and root of caudal, slightly but distinctly before ventral. Pectoral equal to depth of body, extends halfway towards ventral; the latter passes the anal opening and misses the anal by one

diameter of orbit. Caudal very slightly emarginate. Free portion of tail half as high as long, its length equalling that of the head less one diameter of eye.

Greyish green, with irregular transverse bars and blotches; fins dirty orange, D. and C. speckled with black.

Distinguished from *N. rhadinæus*, T. Reg., by the greater depth of body, the position of the eye, and the form and size of the mouth; from *N. macmahoni*, Chaudh., by the length of the ventral, the greater length of the head, and the lesser depth of the body.

Twenty-four specimens, between 100 and 130 mm., were collected at Kelat.

*Nemachilus baluchiorum*, sp. n.

D. 9, P. 10, V. 7, A. 7, C. 18.

Length of head  $5-5\frac{1}{8}$ , depth of body  $6\frac{1}{2}$  in total length. Depth of head  $\frac{8}{9}$  of its breadth, breadth  $1\frac{1}{2}$  in its length. Eye  $\frac{1}{7}$  of length of head,  $\frac{2}{5}$  of interorbital space. Snout as long as postorbital portion of head. Cleft of mouth does not extend to below the nostrils. Lips moderately thick, the lower interrupted. Barbels six, the outer rostral being the longest and extending to front margin of orbit. Scales embedded in the skin, but distinct. Dorsal arises midway between hind nostril and root of caudal, opposite ventral. Length of pectoral equalling that of head less diameter of eye, reaches  $\frac{2}{3}$  towards ventral; the latter does not reach the anus. Caudal distinctly emarginate. Free portion of tail as long as high,  $\frac{1}{8}$  of total length. Males with a movable protrusion of the preorbital.

Greenish yellow, with 11-13 dark olive cross-bars, another nearly black at base of caudal. Anterior base of dorsal with a black mark, dorsal and caudal with oblique rows of spots; lower fins yellow.

In coloration this species is similar to *N. kessleri*, Gthr., but the presence of scales and the size of the orbit make it quite distinct; from the similarly coloured species *N. hampurensis*, Nik., and *N. sargadensis*, Nik., it is easily distinguished by its much greater depth of body. From the above-mentioned *N. brahui* it differs in colour, as well as in the presence of scales, the proportions of the caudal peduncle, and the length of the ventral fin.

Thirteen specimens from Panjgur.

LXXI.—*Apherusa jurinei* (M.-Edw.).

By ALFRED O. WALKER, F.L.S., F.Z.S.

THIS species, which is a not uncommon inhabitant of rock-pools along our coasts, has been rather unfairly treated by describers. A. Boeck (Skand. Arkt. Amph. p. 348, pl. xxii. fig. 6) and G. O. Sars (Crust. Norw. Amphipoda, p. 445, pl. clvii. fig. 1) describe and figure what must be regarded as the typical form, in which the third pleon-segment is thus described by the latter :—"Last pair of epimeral plates of metasome forming a broadish expansion, the inferior corner of which is dentiform, the superior one triangularly produced, edge of the projection quite smooth." Boeck's description is to much the same effect.

In looking over collections from various parts of our coasts, especially those of N. Wales, I have been struck by the great variability of the above segment, the hind margin varying from the form described by Boeck and Sars to an even curve like that of *Calliopius rathkei* figured by Sars in the same plate (2 cp.<sup>3</sup>). A very common form has the acute upper angle reduced to a more or less rounded obtuse angle near the middle of the curve. This appears to be commoner than the typical form in the specimens examined, and is to be seen in specimens of both sexes, all ages, and from various localities.

There are also considerable differences in the antennæ of the males and females which appear to have escaped notice hitherto. All authors agree in saying that antennæ 1 are shorter than ant. 2, but I find that in the adult males they are often subequal and occasionally somewhat longer. The structure of the peduncle of ant. 1 also differs greatly in the two sexes, though no author has called attention to this. Bruzelius and Boeck both speak of a tooth at the end of the lower margin of the last joint of the peduncle, which is not mentioned or figured by G. O. Sars; yet both are strictly correct, the former being the male and the latter the female form. Further, the adult male has, in addition to this tooth, from one to three teeth on the lower margins of the last two joints of the peduncle, each tooth being generally crowned with a calceolus, which I have never seen on the flagellum in this species. These teeth are indicated in Boeck's figure of the antennæ, which are shown of *equal* length.

An adult male with the rounded or subangular form of the hind margin of the third pleon-segment might well be taken



for a distinct species when compared with any published description, which leads to the conclusion that differences of outline in this part *alone* cannot properly be used to distinguish species; and the same may be said of the dorsal hind margins of the body-segments.

LXXII.—*Descriptions of Two new Fishes from the Nile System.* By G. A. BOULENGER, F.R.S.

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A COLLECTION of fishes recently made by Mr. F. J. Jackson, C.B., in Uganda, and presented by him to the British Museum, includes examples of two new species, one of which belongs to a genus which was not previously represented in the fauna of the Nile system.

*Alestes jacksonii.*

Depth of body 3 times in total length, length of head 4 times. Head twice as long as broad, slightly longer than deep; snout rounded, as long as the eye, which is lateral and  $3\frac{1}{2}$  times in length of head; interorbital region feebly convex, its width  $2\frac{2}{3}$  times in length of head; maxillary nearly reaching to below anterior border of eye; 16 teeth ( $\frac{8}{5}$ ) in upper jaw, 10 ( $\frac{8}{2}$ ) in lower; lower border of second suborbital as long as eye. Gill-rakers moderately long, 16 on lower part of anterior arch. Dorsal II 8, originating just behind vertical of base of ventral, at equal distance from eye and from caudal, longest ray as long as head. Anal III 15, pointed in the middle (male). Pectoral nearly as long as head, reaching ventral. Caudal deeply forked, lobes pointed. Caudal peduncle a little longer than deep. Scales with radiating and anastomosing canals,  $26\frac{4\frac{1}{2}}{3\frac{1}{2}}$ , 2 between lateral line and root of ventral. Silvery, brownish on the back, with a rather indistinct dark lateral band from above the gill-cover to the root of the caudal fin; dorsal fin greyish, other fins yellow.

Total length 150 mm.

A single specimen from the Malawa River, Kavirondo, 4000 feet.

Allied to *A. affinis*, Gthr.

*Amphilius jacksonii*.

Depth of body 7 times in total length, length of head  $4\frac{1}{3}$  times. Head much depressed, slightly longer than broad; snout rounded,  $\frac{1}{2}$  length of head; eye small, 6 times in length of head, twice in interocular width; posterior nostril much nearer eye than end of snout; maxillary barbel slightly shorter than head, just reaching root of pectoral; outer mandibular barbel  $\frac{2}{3}$  length of head, inner  $\frac{1}{2}$ . Gill-rakers rather long, 7 on lower part of anterior arch. Dorsal I 6, much nearer end of snout than root of caudal. Adipose dorsal 3 times as long as deep,  $1\frac{1}{2}$  times as long as rayed dorsal, twice its distance from latter. Anal III 7. Pectoral as long as head. Ventral as long as pectoral, well behind base of dorsal, equally distant from end of snout and from root of caudal. Caudal deeply emarginate, crescentic. Caudal peduncle twice as long as deep. Yellowish brown, spotted and marbled with dark brown; a blackish streak from the eye to the maxillary barbel; a blackish bar at the root of the caudal; fins whitish, dorsal with a distal transverse series of black spots, dorsal, ventral, and anal with two black transverse bars, caudal spotted with black.

Total length 100 mm.

A single specimen from the Hima River, eastern foot-hills of Ruwenzori, 3500 feet, flowing into Lake George (Ruisamba).

LXXIII.—*Rhynchotal Notes*.

By W. L. DISTANT.

## H E T E R O P T E R A.

## Fam. Pentatomidæ.

## MABUSANA, gen. nov.

Body subovate, moderately convex; head long, obliquely depressed, its apex subtruncate, lobes of equal length, lateral lobes somewhat flat and ampliate, anteriorly rounded; rostrum about reaching the posterior coxæ, first joint slightly passing base of head, second longest, about reaching intermediate coxæ; antennæ five-jointed, moderate in length, first joint about or almost reaching apex of head, remaining joints longer and subequal in length; pronotum broader

than long, obliquely deflected towards head, posterior angles subprominent and broadly subacutely rounded, anterior angles minutely laterally toothed; scutellum about as broad at base as long, a little longer than pronotum, apex rounded, passing inner angle of corium; corium with the lateral margin a little convex, apical margin oblique, slightly convex; membrane short, apically rounded, scarcely passing abdominal apex, veins robust, about seven in number; tibiæ moderately sulcated.

Type, *M. (Caura) durbanensis*, Dist.

This genus principally differs from *Caura*, Stål, by the structure of the head and shorter and more rounded membrane. I originally included the type in the genus *Caura*, but find it requires distinct generic position.

#### CHAUBATTIANA, gen. nov.

Subelongate; head longer than broad between eyes, narrowed towards apex, the lateral margins distinctly sinuate, somewhat angulate before the eyes; lobes of equal length, the apex subtruncate; eyes large, somewhat strongly produced, reaching the apices of the anterior pronotal angles, ocelli near base of head and close to inner margins of eyes; antennæ five-jointed, basal joint short, not nearly reaching apex of head, remaining joints almost subequal in length, second and third slightly longest; rostrum slender, reaching the posterior coxæ, first joint not reaching base of head, second about reaching anterior coxæ; pronotum about half as long as broad at base, posterior angles not produced, anterior margin concave, lateral margins oblique, entire, neither serrate nor crenulate, basal margin truncate before scutellum, thence oblique to lateral angles; scutellum passing the middle of abdomen, about as long as broad at base, sinuate beyond middle and near inner angle of corium and prominently narrowed to apex, which is rounded, apical margin of corium moderately sinuate; connexivum exposed from about one-third from basal margin of corium; membrane not or only\*slightly passing the abdominal apex; abdomen beneath acutely spined at base, the spine about reaching the apex of posterior coxæ, abdominal spiracles prominent.

This genus, in the arrangement pursued in my Indian *Rhynchota* (Fauna Brit. India), vol. i., will be placed in the division *Nezaria* (p. 218), and in that enumeration must be located near *Piezodorus*.

*Chaubattiana rubrovittata*, sp. n.

Head testaceous, subrugulose, extreme base and posterior margins of eyes ochraceous, ocelli purplish red; antennæ ochraceous, fourth and fifth joints fuscous, base of fourth ochraceous; pronotum testaceous, irregularly punctate, extreme lateral margins, basal margin, an irregular central longitudinal fascia, and a narrow, waved, transverse, linear fascia dull greyish or pale ochraceous; scutellum pale ochraceous, sparingly punctate, and with a somewhat broad, central, longitudinal, sanguineous fascia, in some specimens a sanguineous spot near each basal angle; corium pale ochraceous, finely darkly punctate; body beneath thickly finely punctate, metanotum more or less opaque purplish red; apex of rostrum black; other structural characters as in generic diagnosis.

Long. 8–9 mm.

*Hab.* Bengal; Chaubattia, Kumaon (Brit. Mus.).

This fine species has been recently received from Dr. A. M. Imms.

*Bathycœlia natalicola*, sp. n.

Head, pronotum, and scutellum pale virescent, with irregular darker virescent mottlings, in type principally on apical area of head; posterior disk of pronotum and apical area of scutellum, lateral margins of head and pronotum (narrowly) indigo-blue; corium dull pale ochraceous, its lateral margin before base of connexivum pale bright ochraceous, its remaining lateral margin narrowly indigo-blue; membrane subhyaline; connexivum bright ochraceous, its inner and outer margins virescent; body beneath and legs pale ochraceous or virescent, anterior and intermediate tibiæ and tarsi, and bases and apices of posterior tibiæ, pale purplish brown; extreme lateral margins of head beneath and sternum indigo-blue, apical segmental segment olivaceous; antennæ carmine-red, first joint short, not reaching apex of head, second a little longest, third and fourth subequal, fifth mutilated in type; head above finely transversely wrinkled, ocelli red; pronotum finely punctate and subrugulose, the basal area a little convexly rounded, thence oblique to anterior margin; scutellum finely punctate and slightly wrinkled, a bright distinct black spot in the foveations at basal angles; corium thickly finely punctate; membrane moderately passing the abdominal apex; rostrum with the second joint reaching the intermediate coxæ, remainder



mutilated in type; abdomen beneath broadly, centrally, longitudinally grooved, its marginal ridges a little elevated.

Long., ♂, 18 mm.

*Hab.* Natal; Tongaat (*H. C. Burnup*, Brit. Mus.).

Apart from its distinct coloration and markings this species may be recognized by the slight but distinct convexity of the basal areas of both scutellum and pronotum. It is the first species of the genus to be received from South-east Africa.

*Bathycœlia variolaria*, sp. n.

Head, pronotum, and scutellum dark virescent, lateral margins of pronotum narrowly carmine-red; corium ochraceous, the lateral margin narrowly virescent; connexivum dark virescent; membrane subhyaline; body beneath pale virescent, central area of abdomen and the legs pale ochraceous; tibiæ and tarsi pale carmine-red; antennæ very pale purplish, nearly apical half of third joint black, first joint not reaching apex of head, second joint considerably shorter than third, remaining joints mutilated in type; head finely wrinkled, the lateral lobes concavely grooved; pronotum somewhat sparingly but coarsely punctate; scutellum finely punctate, obscurely wrinkled; corium thickly somewhat coarsely punctate; membrane passing abdominal apex; rostrum reaching the base of the fourth abdominal segment; abdomen beneath broadly longitudinally grooved; sternum more or less thickly finely punctate.

Long., ♂, 16½ mm.

*Hab.* Uganda Prot.; Entebbe (Forest), 300–600 feet (*S. A. Neave*, Brit. Mus.).

SYNONYMICAL NOTE.

*Thoria natalensis*, Stål, = *Neocrollius natalensis*, Dist.

HOMOPTERA.

Fam. Jassidæ.

Subfam. BYTHOSCOPINÆ.

*Idiocerus maculatus*, sp. n.

Head, pronotum, and scutellum ochraceous, head and pronotum more or less suffused with dull greyish, scutellum with three large triangular black spots at base and four very small black spots on disk; body beneath and legs

ochraceous; tegmina subhyaline, costal margin ochraceous, venation black, an elongate inwardly curved black spot near middle of costal margin, and the apical margin also black; a spot at base of face, another near apex of clypeus, and apices of posterior tibiae black; ocelli nearer to eyes than to each other; front (including face) about as long as broad; front of head between eyes about three times as broad as long; scutellum about as long as head and pronotum together; posterior tibiae with small brown spots and finely spinulose.

Long., incl. tegm., 5 mm.

*Hab.* Brit. India; Orissa, Gopuda Island, Lake Chilka (Ind. Mus.).

*RADHADES*, gen. nov.

Front of head short and broad, as seen above about five times as broad as long, on each side obliquely directed backward to eyes; ocelli beneath between the eyes, nearer to eyes than to each other, front (including face) short and broad, considerably broader than long, the face moderately convex; pronotum at base about twice as long as broad, moderately gibbous, anterior margin rounded, basal margin somewhat strongly sinuate before scutellum, which is a little shorter than broad, distinctly shorter than pronotum, transversely impressed before apex, which is subacute; tegmina hyaline, five apical and three subapical cells; costal membrane broad, claval vein rounded; posterior tibiae somewhat slender, finely spinulose.

A genus which may be placed near *Bythoscopus* by the short and broad front (including face); the ocelli are nearer base of face, the front of head above is obliquely deflected to eyes, and the pronotum profoundly sinuate at base.

*Radhades crassus*, sp. n.

Head, pronotum, and scutellum pale fuscous brown; scutellum with a black spot at each basal angle, the lateral margins ochraceous, widened before apex; abdomen above pale fuscous brown, posterior segmental margins ochraceous, the apical segment nearly wholly ochraceous; body beneath and legs pale ochraceous, tibiae black; head, face, and pronotum thickly coarsely punctate, scutellum more finely punctate; tegmina with the basal and claval areas semi-opaque, ochraceous, and obscurely finely granulate; other structural characters as in generic diagnosis.

Long., incl. tegm., 5 mm.

*Hab.* Tenasserim Valley; Myitta (*Doherty*, Brit. Mus.).

*Agallia rugosa*, sp. n.

Head, pronotum, and scutellum ochraceous mottled with fuscous, the head as seen above less darkly so; scutellum with a reversed triangular black spot near each basal angle and with a smaller dark basal spot between them; front and face paler, with a small black spot near the insertion of the antennæ; body beneath piceous or black; legs ochraceous; tegmina with the clavus brownish ochraceous, its outer margin broadly pale ochraceous, beyond the claval area the colour is blackish, with the costal margin gradually widening to and including the apical area ochraceous; pronotum, scutellum, and claval area of tegmina finely granulose; ocelli placed about as near to each other as to eyes; scutellum about as long as pronotum; head (together with the eyes) wider than tegmina at base; face (including clypeus) nearly as long as width across eyes; pronotum anteriorly convexly rounded between the eyes.

Long.  $3\frac{1}{2}$  mm.

*Hab.* N. Bengal (Brit. Mus.).

Allied to *A. plotina*, Dist., but differing in its granulose upper surface and distinct coloration.

*Agallia montana*, sp. n.

Head and pronotum ochraceous; vertex with two central longitudinal spots, a smaller spot between them, and a spot near inner margin of each eye black; pronotum with a large waved fasciate spot on each lateral area, commencing on anterior but not reaching posterior margin, and a short line between them nearly reaching middle, black; scutellum black, the lateral margins (not reaching base) ochraceous; body beneath and legs ochraceous; front with a central longitudinal line, two small spots on anterior margin, and a larger spot between eyes and ocelli black; margins and apex of face, the whole of the clypeus, and irregular spots to cheeks black; posterior margin of mesosternum, abdomen beneath (excluding apex) black; tegmina pale ochraceous, subhyaline; ocelli placed as near to each other as to eyes; scutellum a little shorter than pronotum; head together with the eyes wider than tegmina at base; vertex of head very slightly rounded in front, almost truncate.

Long. 5 mm.

*Hab.* Simla, 7000 feet (*H. M. Lefroy*, Brit. Mus.).

Allied to *A. atrovenosa*, Melich., from which it differs in the more truncate vertex between the eyes and different markings and coloration.

## SITADES, gen. nov.

Vertex short, shorter at middle than on lateral areas, where it is distinctly grooved before eyes; ocelli placed on front just beneath the anterior margin of the vertex, nearer to each other than to eyes; face a little longer than broad, rounded anteriorly; pronotum somewhat convex, foveately depressed on each lateral area, anterior margin moderately rounded, posterior margin slightly sinuate; scutellum a little shorter than pronotum, broader than long, its apex acute; tegmina moderately broad, passing abdominal apex; costal margin rounded, veins coarse and prominent, apical cells five; posterior tibiæ shortly, thickly, finely spinulose.

Allied to *Moonia*, Dist., but differing in the largerscutellum, narrower and more elongate face, &c.

*Sitades fasciatus*, sp. n.

Vertex of head and pronotum pale ochraceous, the first with a dark indentation before each eye; scutellum brownish ochraceous, with the basal margin (centrally broken) black; body beneath and legs ochraceous, apices of femora annulated, and tibiæ spotted with brownish; tegmina pale umber-brown, apical area of clavus and an oblique longitudinal fascia commencing before middle, terminating before apical area, and anteriorly transversely continued towards costal area, dull greyish, outer claval margin with piceous linear spots, between which are small pale spots, the claval vein somewhat similarly marked, the general venation also distinctly darker and marked with small pale spots; at the posterior termination of the greyish fascia are two piceous blotches or spots; pronotum thickly finely granulose; front of head beneath with the ocelli distinctly darker, and a small black spot near the insertion of the antennæ; other structural characters as in generic diagnosis.

Long. 4 mm.

*Hab.* Bengal (Brit. Mus.).

## DURGADES, gen. nov.

Head with the vertex short and broad, centrally carinate, the eyes extending beyond the anterior angles of the pronotum; shorter at middle than on lateral areas; ocelli placed on front between eyes, nearer to eyes than to each other and nearer to base of face than to the anterior margin of the vertex; face about as long as broad, rounded anteriorly; pronotum about twice as broad as long, anterior margin



rounded, posterior margin sinuate, posterior angles somewhat obliquely rounded; scutellum broader than long, shorter than pronotum, its apex angularly acute; tegmina moderately broader, extending beyond abdominal apex, costal margin convexly rounded, venation distinct, apical cells five, claval vein inwardly rounded; posterior tibiæ distinctly spinulose.

Differs from the preceding genus *Sitades* by the ocelli being placed nearer to base of face than to the anterior margin of the vertex, and nearer to eyes than to each other, and by the venation of tegmina, especially on clavus.

*Durgades nigropictus*, sp. n.

Vertex of head ochraceous, with two black spots about as far from each other as from eyes; pronotum and scutellum pale fuscous brown, the latter with a central longitudinal blackish spot and a much smaller basal spot on each side; body beneath and legs pale brownish; tegmina with about interior basal half brownish, remainder dull pale ochraceous, some of the veins longitudinally streaked with black; front of head beneath with two small black marginal spots and with a black line between them; other characters as in generic diagnosis.

Long.  $4\frac{1}{2}$  mm.

*Hab.* Eastern Himalayas (Brit. Mus.).

LXXIV.—*Descriptions of new African Agaristidæ in the British Museum.* By Sir GEORGE F. HAMPSON, Bart.

THE numbers refer to the 'Catalogue of Lepidoptera Phalaenæ in the British Museum.'

65 a. *Xanthospilopteryx flavisignata*, sp. n.

♂. Head and thorax black; first and second joints of palpi, sides of frons, vertex of head, tegulæ at middle and sides, and the patagia with paired yellow points, the meso- and metathorax with yellow points; pectus and femora with some yellow, the tibiæ striped with orange, the tarsi ringed with yellow; abdomen banded orange and black above and below. Fore wing black; three slight yellowish spots below basal part of costa and a slight spot below the cell; a small, triangular, yellow antemedial spot in cell and two

small oblique spots above vein 1; a broad oblique bar across end of cell and an elliptical patch below the cell; an oblique band from below costa beyond middle to vein 4 towards termen, its lower extremity curved outwards and separated by a black streak on vein 4 from a yellow spot below vein 4; a small spot above tornus; some slight silvery blue marks on basal area, an oblique striga in middle of cell, and a line on discocellulars; cilia yellowish white at apex. Hind wing reddish orange; a black terminal band, rather broad at apex, somewhat expanding at vein 2, and narrowing to tornus; cilia yellowish white at apex.

*Hab.* BR. E. AFRICA, E. Victoria Nyanza, Lusinga (*Neave*), 2 ♂ type. *Exp.* 66 mm.

69 a. *Xanthospilopteryx atrifusa*, sp. n.

♂. Head and thorax black; first and second joints of palpi, sides of frons, vertex of head, tegulæ at middle and sides, and patagia with paired white points; pectus and femora with some white, the tibiæ orange and black, the tarsi brown; abdomen black, with narrow white segmental bands, the second and third segments with some yellow at sides, the anal tuft orange. Fore wing black; a white point below base of costa; a small triangular white antemedial spot in the cell, a slight spot above vein 1, and short streak above middle of inner margin; a quadrate white patch in end of cell and oblique quadrate patch below the cell; a post-medial trifold patch below the costa, divided by black streaks on veins 7, 6, an elongate spot above vein 4 and spot below vein 4; a small spot above tornus; some slight silvery blue marks on basal area, an oblique striga in middle of cell, a slight streak below middle of cell, and line on discocellulars; cilia white at apex. Hind wing pale yellow suffused with black; the inner area except towards base less suffused; the terminal area black, expanding widely on costal area and narrowing to tornus, its inner edge rather diffused; cilia white at apex; the underside pale yellow, the costal area orange to the black terminal area and the costa narrowly black to base.

*Hab.* UGANDA, Semliki Plains (*Neave*), 1 ♂ type. *Exp.* 68 mm.

73 a. *Xanthospilopteryx atribasalis*, sp. n.

♀. Head and thorax black; first and second joints of palpi, sides of frons, vertex of head, tegulæ at middle and sides, and patagia with white points; gulæ white; femora

streaked with whitish, the fore tibiæ with some orange, the mid and hind tibiæ at extremities and the tarsi ringed with white; abdomen pale yellowish mixed with blackish, the ventral surface more orange, lateral series of small black spots. Fore wing black; three slight whitish spots below basal part of costa; slight whitish antemedial spots below costa and cell and above vein 1; a rather quadrate yellow patch in end of cell and oblique patch below the cell; an oblique yellow postmedial band from below costa to vein 4, traversed by slight dark streaks on the veins, its lower extremity excurved and with a spot below it; a small spot above tornus; the basal area with slight silvery blue marks, an oblique striga in middle of cell, and discoidal line; cilia white at apex. Hind wing orange, the inner margin reddish, the base black; the terminal area black, broad at costa, expanding at vein 2 and narrowing to tornus; cilia white at tips; the underside scarlet, the black on costa extending to middle.

*Hab.* BR. E. AFRICA, S. Kakumega Forest, Yala R. (*Neave*), 2 ♂ type. *Exp.* 72–80 mm.

*Aphægocera aurantipennis*, sp. n.

♂. Head and thorax black; first and second joints of palpi with white spots; frons white at sides; gulæ white; tegulæ at middle and sides, patagia, meso- and metathorax with white spots, the patagia at tips and sides of metathorax with orange-red hair; pectus orange; femora streaked with orange, the tibiæ at extremities and tarsi ringed with white; abdomen black, with narrow white segmental bands, the sides with some orange at base. Fore wing reddish orange; the terminal area black-brown, very broad at costa, and extending as a triangular patch into upper extremity of the cell, where there is a white spot on it, narrowing to tornus; a white postmedial patch between veins 7 and 4, traversed by dark streaks on veins 6 and 5, and small subterminal spots below veins 4 and 3; a silvery blue discoidal bar; cilia with some white above tornus. Hind wing reddish orange; a narrow black-brown terminal band, expanding somewhat at vein 2 and inner margin; cilia chequered black-brown and white.

*Hab.* UGANDA, Kampala (*Neave*), 1 ♂ type. *Exp.* 62 mm.

## LXXV.—Two new Mongooses from Somaliland.

By R. E. DRAKE-BROCKMAN, M.R.C.S., L.R.C.P., F.Z.S.

*Helogale hirtula annulata*, subsp. n.

This subspecies somewhat resembles *H. hirtula* in general characters, but may readily be distinguished from it by the darker grizzling on its head and face and the suffusion of reddish fawn on back.

Underneath it more closely resembles *H. hirtula lutescens*. Unfortunately the type of the latter is a young adult, so it is difficult to compare the two satisfactorily; but when comparing the whole *hirtula* group this subspecies is seen to stand out, owing to the fact that it is not only darker but the basal part of the fur is dark brown or even black.

In the Annals & Mag. of Nat. Hist. ser. 8, vol. viii., Thomas mentions this specimen and regards it as a fully adult specimen of *H. hirtula lutescens*, but owing to the characteristics above mentioned and the fact that it is a far cry from Lake Rudolf to Afgo on the Webi Shebeleh, I am of opinion that it is entitled to a distinct name.

The measurements of the type (in the flesh):—

Head and body 243 mm.; tail 185 mm.; hind foot 45 mm.; ear 15 mm.

Skull (somewhat damaged): posterior end of interparietal suture to gnathion 53.5 mm.; zygomatic breadth 29 mm.; interorbital breadth 11.5 mm.; palatal length 26 mm.; front of canine to back of  $m^2$  18 mm.

*Hab.* Afgo, Webi Shebeleh, near Mogadishu, Italian Somaliland.

*Type.* Adult male. B.M. no. 11. 8. 2. 11. Original number 358. Collected 26th January, 1910, by myself and presented to the British Museum.

When shot this animal was alone, a very unusual coincidence, as the members of this genus I have always seen in small packs.

*Helogale hirtula powelli*, subsp. n.

This subspecies is like the typical "*hirtula*" obtained by Dunn in Central Somaliland, but the general appearance is very much lighter. The colouring of the throat and belly is very similar, but the underfur and the basal parts of the long hairs of the back have a much more reddish coloration. The backs of the hands and feet are also much paler and



lack the black hairs found at the bases of the nails in the typical "*hirtula*."

Dimensions of the type (measured in the flesh) :—

Head and body 256 mm.; tail 193 mm.; hind foot 44 mm.; ear 27 mm.

Skull: condylo-basal length 54.5 mm.; zygomatic breadth 31 mm.; interorbital breadth 12 mm.; breadth of brain-case 23 mm.; front of canine to back of  $m^2$  19 mm.

*Hab.* Eil Hur, near Obbia, Italian Somaliland.

*Type.* Adult male. Original number 595. Collected by me Jan. 1912 and presented to the British Museum.

I was fortunate in obtaining two other specimens of this mongoose at Gharabwein, a day's march distant from Eil Hur, and they both possess the same distinctive pale coloration. It gives me much pleasure in naming this mongoose after my friend Mr. H. T. Powell, Treasurer of the Somaliland Protectorate.

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LXXVI.—*On the Development of the Pectoral Girdle in the Pipefish (Syngnathus acus).* By T. P. BUIST, M.A., B.Sc., Gatty Marine Laboratory, University of St. Andrews.

[Plate XIII.]

THE most important contribution to the study of the anatomy of the Lophobranchs is undoubtedly Professor Jungersen's recent paper\*, including as it does both an exhaustive account of the comparative anatomy of the group, prepared from his own investigations and illustrated with a large number of exceedingly clear and accurate figures, and a critical review of the previous literature, bringing the whole subject completely up to date. Jungersen gives a full and accurate description of the pectoral girdle of the adult pipefish, and also records the less perfect descriptions of earlier writers. This renders it unnecessary to do more here than mention a few points which are of importance in relation to the special purpose of this paper.

Superficial in position the pectoral girdle in the pipefish enters into intimate relations with the adjoining plates of the dermal armature, and differs greatly from that of other

\* H. F. E. Jungersen, "Ichthyotomical Contributions.—II. The Structure of the Aulostomidae, Syngnathidae, and Solenostomidae," D. Kgl. Danske Vid. Selsk. Skrifter, 7 Række, Nat. og Math. Afd. viii, 5 (1910).

fishes, especially in the peculiar proportions of the coraco-scapular skeleton. The main part of the coraco scapular skeleton is a triangular cartilaginous plate, the "intermediate cartilage," attached by its apex in front and below to the ossified coracoid and above and behind by its base to the small scapula and four proximal radials, also ossified.

The coracoid (fig. 1) consists of two main limbs, forming a somewhat obtuse V, and of a smaller arm within the angle of the V. One limb (*pt p*) is directed backward, tapered at its posterior extremity, and attached internally by a flattened surface to its fellow of the opposite side. The other limb (*pr.p'*) is slighter and wedge-shaped; it passes upward and outward and articulates with the posterior aspect of the inner branch of the stem of the clavicle. The arm of the coracoid divides the angle into two unequal parts, the upper being the smaller, and is directed upward, backward, and outward to join the apex of the intermediate cartilage.

The proximal radials are four ossicles with slender middles and expanded proximal and distal extremities. The distal extremities bear pairs of small ragged processes, carrying the distal radials, and also minute recurved processes which anchor the ossicle to the lips of the cleft in the dermal armature through which the fin passes.

The scapula is similar to the proximal radials, but its distal extremity is expanded into two arms, the upper and anterior being attached to the clavicle, while the posterior articulates with the distal extremity of the upper proximal radial.

The clavicle is roughly T-shaped; the upper part is attached internally to the transverse processes of the first and second vertebræ, while the stem forks and the branches are attached to the jugular plate. Through the two foramina thus formed a pair of muscles pass forward from the trunk, and, after joining to form a single median tendon, are inserted into the urohyal.

Owing to the difficulty of procuring the requisite material a complete range of embryonic stages has not been available, and a description of the earlier stages has therefore had to be omitted. The figures were prepared from serial sections by the contour method of reconstruction\*. Ehrlich's acid hæmatoxylin followed by orange G in 70 per cent. alcohol as a slide-stain was used in the preparation of the sections.

*Stage I.*—The youngest stage procured, 21 mm., was taken from the pouch of a specimen from the University

\* T. P. Buist, "A Method of Reconstruction by Contours," Journ. Anat. & Phys. vol. xlvii. (1913).

Museum. In this stage the post-temporal has not yet appeared, but the clavicle already gives an indication of its final shape. It has somewhat the form of an inverted L, consisting of a thin laminar upper part and a slender stem. The laminar upper part is attached by an intervening mass of fibrous tissue to the transverse process of the first vertebra, and extends forward to near the skull, but does not yet extend back much behind the stem. The stem passes downward and finally inward, and terminates above the inner edge of the muscle to the hyoid in a median mass of fibrous tissue which connects it with the jugular plate, the lower angle of the coraco-scapular cartilage, and the clavicle of the opposite side.

At this stage in the development the cartilaginous part of the shoulder-girdle is still predominant, and consists on either side of a vertical triangular coraco-scapular plate in which the parts are as yet imperfectly differentiated. This cartilaginous plate is slightly concavo-convex, with the convexity outward and the curvature more accentuated behind than in front. The region of the antero-inferior angle represents the coracoid, and at its vertex the cartilage is continued downward on the inner side of the stem of the clavicle to form the precoracoid process, which terminates beside its fellow in the median mass of fibrous tissue already noted. The postcoracoid process has not yet appeared. The scapular portion is represented by the upper angle of the cartilage, which bears the small vertical scapular process. On the anterior border of the cartilage toward the lowest point of the scapular region a small hook of the cartilage projects forward inward and downward, producing a well-defined notch, which is probably the rudiment of the scapular foramen\*. In stage II. this notch has disappeared, the structures which passed through it passing round the anterior border of the cartilage as in the adult.

Toward the posterior margin of the cartilage four foramina which pierce the cartilage in a vertical series indicate the formation of the radial elements. The lowest foramen is as yet small, and is evidently the most recent. The uppermost foramen separates the first proximal radial from the upper

\* Cf. Derjugin, Zeitschr. f. wiss. Zool. xevi. (1910). A very similar condition of this foramen is presented in the figure of the girdle of an 8 mm. *Lophius* (p. 599) and also in a 5 mm. *Gobius minutus* (pl. xxvii. fig. 16). The foramen in this case becomes completed subsequently. In the same figure may be seen another notch lower down on the anterior border of the cartilage, which in the next stage (8 mm., fig. 17) is almost a complete foramen bounded above by a hook of cartilage, but eventually disappears again (18 mm., fig. 18).

part of the scapular region, which has itself many of the characters of a proximal radial and carries two distal radials with their fin-rays. The posterior margin of the cartilage is convex and is in relation with twelve nodules of cartilage, the distal radials, which bear the elements of the twelve fin-rays.

Between the coracoid at the proximal or antero-inferior angle, and the scapula and the four radial elements which occupy the distal or posterior border with the upper and postero-inferior angles, lies an intermediate region which forms from a third to a half of the whole cartilage. This "intermediate cartilage" is notable in that, although practically absent in the adult in most teleosts, in the pipefish it persists, and in the adult actually forms the greater part of the coraco-scapular skeleton.

The two nuchal plates appear to develop in the same manner as the other plates of the body-armour. In the 21 mm. embryo they are found as a pair of small thin bony scutes each enclosed in a well-defined "flattened sac" very similar to that described by Kazaneff\*. Their development is at a stage between Kazaneff's figures 4 and 5, and is thus a little behind that of the other plates of the region.

*Stage II.*—In a 28 mm. embryo, near the term of intramarsupial life, the post-temporal is present in the form of a slender V-shaped ossification at the anterior end of the upper part of the clavicle. The clavicle is stouter than in the last stage and has now the general form and features of its adult state. The stem is branched and the outer branch passes downward external to the muscle to the hyoid and gives support to the upper part of the jugular plate. The upper laminar part of the clavicle extends backward behind the stem, and is attached to the transverse process of the second vertebra as well as to that of the first.

In this stage the coraco-scapular cartilage (fig. 2) still forms the greater part of the shoulder-girdle and is now flat behind. The coracoid region (*c*) is better defined than in the previous stage, being slightly thicker than the remainder of the cartilage, to the plane of which it now lies somewhat internal. The precoracoid process (*pr.p*) has increased considerably in diameter without any appreciable increase in length, and is no longer a distinct process, but rather a part of the coracoid. The postcoracoid process (*pt.p*) forms a small ossified projection at the posterior border of the

\* Kazaneff, "Ueber die Entstehung des Hautpanzers bei *Syngnathus acus*," Zool. Anz. xxx. (1906).



coracoid, just below its junction with the remainder of the cartilage.

The most notable change in the coraco-scapular cartilage, however, is in the scapular region. The scapula (*sc*) consists of a short stout vertical column, continuous at its proximal end with the "intermediate cartilage" (*cs*) and with the base of the first proximal radial (*R*). From its distal end a more slender column passes backward over the uppermost of the four foramina to the posterior margin of the cartilage, where it again meets the first proximal radial and is in relation with two of the distal radials. This horizontal part is attached to a projecting ledge on the posterior arm (*i. e.* behind the stem) of the laminar portion of the clavicle. The scapular process (*sc.p*) points forward instead of upward, but does not yet take part in the attachment to the clavicle. The scapular foramen or notch has disappeared, being merged in the larger space enclosed between the clavicle and the coraco-scapular cartilage.

*Stage III.*, 33 mm., about a fortnight after the young fish has left the brood-pouch.—In this stage the skeleton presents a new feature in the commencement of ossification of the cartilages, the surfaces of many bearing a thin coat of clear non-cellular material like the substance of the membrane bones.

Beyond an obvious increase in size and strength the post-temporal and the clavicle differ little from the previous stage. The inner branch of the stem of the clavicle has grown toward the jugular plate, but has not yet reached it.

The appearance of the coracoids at this stage is shown in fig. 3. The coracoid (*co*) is now distinctly marked off from the remainder of the cartilage, to which it is joined by a thin neck. The precoracoid process (*pr.p*), directed slightly outward, is very short in comparison with its thickness, and has become practically the anterior part of the coracoid (*co*). At its anterior end the precoracoid process is attached to the inner branch of the stem of the clavicle (*i.cl*). The postcoracoid process (*pt.p*), slightly larger than in stage II., is a small somewhat conical tuberosity at the posterior end of the coracoid, behind and below the neck connecting it with the remainder of the cartilage. This process is ossified, and from its base the first traces of ossification extend forward over the surface of the coracoid toward the precoracoid process.

The anterior border of the coraco-scapular cartilage is curved inward above to the point where it is attached to the clavicle through the medium of the anterior part of the

scapula. The scapular process is directed forward as in the previous stage, but now takes part in the attachment. In this region also ossification has commenced, but it is as yet only partial and superficial. The proximal radials have now approximately attained their adult shape, but show no traces of ossification, and are continuous with the remainder of the coraco-scapular cartilage. Externally and internally respectively the proximal radials are now overlapped by the cover-plate and the mid lateral plate of the second ring, and are attached to them by connective tissue. Above, the scapula is similarly loosely anchored within a cleft in the clavicle.

*Stage IV.*, 44 mm.—The post-temporal is now roughly Y-shaped and is attached in front to the skull by its two branches and behind by its stem to the fore-end of the clavicle. The inner branch of the stem of the clavicle curves toward the mesial plane and is attached at its inferior extremity to the jugular plate; it thus completes between the jugular plate and the two branches of the clavicular stem the osseous foramen through which the muscle to the hyoid passes.

The coracoid (fig. 4, *co*) is a roundish mass of cartilage lying close to its fellow of the opposite side; its anterior third is the greatly thickened precoracoid process (*pr.p*) which connects it with the inner branch of the stem of the clavicle (*i.cl*). From the upper and posterior part of the coracoid the postcoracoid process (*pt.p*), now comparatively long and slender, passes backward and downward, and its upper and outer surfaces give origin to part of the fin-muscle. The "arm" of the coracoid arises from the upper part of the external aspect of the coracoid, and passes outward and upward to join the intermediate cartilage. The postcoracoid process is ossified throughout its whole substance, while the remainder of the coracoid, including the precoracoid process and the arm, is ossified superficially.

The scapula in its form and function is now almost identical with the four proximal radials. In the two uppermost of these ossification has commenced, but there is as yet no sign of the peculiar serrations and "anchoring processes" of the distal end which develop later.

An important feature of the last two stages is the stiffening of the pectoral skeleton and the changing of the support of the pectoral fin from the coraco-scapular girdle to the dermal plates enclosing the fin-cleft. In the subsequent development these changes are carried on to their completion. The attachment of the clavicle to the transverse processes of the

first two vertebræ is strengthened by the development of longitudinal ridges on the internal aspect of the bone. With the advance of ossification the small processes appear on the proximal radials, and the scapula and proximal radials become differentiated from the intermediate cartilage. As the body of the coracoid becomes ossified the vertical limb (fig. 1, *ppp'*) arises as an upward extension from the anterior end, *i. e.* from the precoracoid process, while the postcoracoid process develops into the posterior half of the horizontal limb (*pt.p*). The arm ossifies with the remainder of the coracoid, but its upper end remains hollow, to give a better attachment to the intermediate cartilage.

The formation of a practically continuous dermal armour of bony scutes, and its special strengthening to produce a more rigid framework in the pectoral region by the restriction of the movements of its individual parts, are closely connected with the development of the pectoral girdle in the pipefish, and are responsible for most of the peculiarities of the adult girdle.

The clavicle apparently arises as a slender vertical bar in front of the coraco-scapular cartilage, and expands both forward and backward at its upper end, to have a rigid vertebral attachment and to form part of the dermal armour.

The development of the primary cartilaginous shoulder-girdle presents several peculiar features. The scapular region is small and is primarily limited by a foramen in the cartilage, which apparently rises in conjunction with and in the same way as the three foramina by which the four proximal radials are initially indicated, and with which it forms a series of four which persists in the adult. There is apparently no other sign of a division of the primary shoulder-girdle into a true coraco-scapular and a radial cartilage. A true scapular foramen is present in the earlier stages, but eventually becomes merged in the large opening between the coraco-scapular cartilage and the clavicle. A scapular process is also present, and persists in the adult as the upper arm of the scapula. The adult scapula becomes distinct from the remainder of the coraco-scapular cartilage by ossifying into a small bone which closely resembles the proximal radials in form and dimensions, as well as in its genesis. The reduction of the scapula and its resemblance to a proximal radial are found in various lesser degrees in the Hemibranchiate fishes, and may be traced through a series of stages ending with *Fistularia*, which presents an arrangement of these parts closely allied to that in *Syngnathus*.

With the reduction of the scapula the intermediate cartilage is correspondingly increased and carries the four proximal radials, which, as in the case of the scapula, become distinct from the remainder of the cartilage by their ossification. The transfer of the direct support of the pectoral fin from the internal to the external skeleton renders a largely ossified coraco-scapular region unnecessary.

The coracoid becomes defined by its growth and by the constriction of its connexion with the remainder of the cartilage. The precoracoid process is distinct at first, but eventually forms part of the mass of the coracoid. A posterior process is also developed which, although not actually preformed in cartilage, but arising rather as an extension of the ossifying coracoid, occupies the position and relations usually associated with the postcoracoid process in teleosteans. The postcoracoid process becomes attached to the jugular plate, although it does not fuse with it. Its relations thus present an interesting resemblance to those of the postcoracoid process and infracleithrum in *Gasterosteus* as described by Swinnerton \*. Whether this can be regarded as more than an analogy is extremely doubtful. After ossification has commenced the vertical limb arises as an extension of the coracoid and restricts the movements at the coraco-clavicular joint. The coracoid thus acts as a bracket for the rigid support of the jugular plate at its attachment to the clavicle.

Jungersen was the first to recognize this bone as the coracoid, previous writers having usually regarded it as an interclavicle. The facts of its development as here shown leave no doubt that Jungersen's interpretation is correct.

I have to express my gratitude to Professor M'Intosh for continual stimulus and encouragement, and Dr. G. A. Boulenger for his kindly advice and assistance; also to Professor Sutherland, of University College, Dundee, for the freedom of his laboratory during part of the research. To Dr. Williamson, of Nigg Bay, Aberdeen, I am much indebted for assistance in obtaining material for the work.

\* H. H. Swinnerton, "A Contribution to the Morphology and Development of the Pectoral Skeleton of Teleosteans," Q. J. M. S. xlix. ii. (1905).

Swinnerton found no postcoracoid process in *Siphonostoma*, a closely allied genus, but it is possible that the process had been overlooked or had not yet appeared.



## EXPLANATION OF PLATE XIII.

- Fig. 1.* *Syngnathus acus*. Left coracoid of adult, external aspect.  
*Fig. 2.* Ditto, 28 mm. (Stage II.). Left coraco-scapular plate, internal aspect.  $\times 110$ .  
*Fig. 3.* Ditto, 33 mm. (Stage III.). Right and left coracoids, seen from above.  $\times 110$ .  
*Fig. 4.* Ditto, 44 mm. (Stage IV.). Coracoid region, internal aspect.  $\times 110$ .

*Lettering.*

R, proximal radial; *r*, distal radial; *cl*, portion of clavicle; *i*, inner, *o*, outer branch of stem of clavicle; *co*, coracoid; *cs*, part of intermediate cartilage; *pr.p*, precoracoid process; *pr.p'*, vertical limb of coracoid; *pt.p*, postcoracoid process; *sc*, scapula; *sc.p*, scapular process.

LXXVII.—*Notes on some New Zealand Pselaphidæ in the British Museum, with Descriptions of new Species of the Genus Sagola.* By Major T. BROWN, F.E.S.

IN May last, quite unexpectedly, a box containing about eighty specimens of Pselaphidæ was received from the British Museum, together with a letter from Mr. Gilbert J. Arrow requesting me to name the insects. These specimens formed part of Dr. D. Sharp's collection, which has recently become the property of the National Museum, and had been found by Mr. R. Helms about thirty years ago, chiefly in the South Island.

In this paper I have endeavoured to give an account of such of the specimens as belong to the genus *Sagola* in the Faronini, which, perhaps, is the most complex we possess.

In a previous paper (Ann. & Mag. Nat. Hist. ser. 8, vol. viii. p. 488, Oct. 1911) it was shown that this genus then comprised sixty-three species. Those now added make a total of seventy-five, and there can be no doubt that the number will soon be augmented.

The study of these old and rather roughly mounted insects was far from being an easy matter. There was only one of each species, some were not in good order and were more or less embedded in gum. They had to be removed from the cardboard and carefully cleaned, so that the structure of the underside might be examined. Those who have no experience in such tedious and delicate operations should ascertain by actual practice what it means, always bearing in mind

that a large specimen is less than the sixth of an inch in length.

These insects are not agriculturalists' pests. Many years ago I found them destroying Acaridæ, and during Oct. 1911 I kept three specimens of *Sagola eminens* (2724) under close observation, along with the dead vegetable rubbish, Acaridæ, Lipuridæ, &c., amongst which they were found, and watched them feeding on the *Lipuræ*.

The remainder of the specimens, belonging principally to the Euplectini, will, if all goes well, be dealt with in a later paper.

THOS. BROUN.

Mount Albert,  
Auckland, N.Z.,  
31st August, 1912.

*List of Species examined.*

1877.	<i>Sagola sobrina</i> , Broun.	Tairua.
3364.	„ <i>nitida</i> , Broun.	Greymouth.
3482.	„ <i>carinata</i> , sp. n.	„
3483.	„ <i>ventralis</i> , sp. n.	„
3484.	„ <i>occipitalis</i> , sp. n.	„
3485.	„ <i>longula</i> , sp. n.	Auckland.
3486.	„ <i>pallidula</i> , sp. n.	Greymouth.
3487.	„ <i>spiniventris</i> , sp. n.	Picton.
3488.	„ <i>grata</i> , sp. n.	„
3489.	„ <i>bifoveiceps</i> , sp. n.	Greymouth.
3490.	„ <i>hiimpressa</i> , sp. n.	„
3491.	„ <i>clavatella</i> , sp. n.	„
3492.	„ <i>lawsoni</i> , sp. n.	Auckland.
3493.	„ <i>latula</i> , sp. n.	Greymouth.
—	„ <i>frontalis</i> , Raffray.	Bealey.
—	„ <i>punctulata</i> , Raffray.	Greymouth.

The numbers are in correspondence with the author's 'Manual of New Zealand Coleoptera.'

3482. *Sagola carinata*, sp. n.

Shining, sanguineous; legs and antennæ paler; pubescence yellowish, rather elongate, subdepressed, mingled with longer erect setæ on the wing-cases and abdomen; the body elongate and subdepressed.

*Head* rather smaller than the thorax, gradually narrowed behind the eyes, with obtuse hind angles; it is finely and indefinitely punctate; along the middle there is a carina which, in front, is transformed into a very slender groove; this separates the flat antennal tubercles; occipital foveæ punctiform, yet moderately large. *Thorax* subcordate, rounded and widest before the middle, more obliquely

narrowed in front than behind, its length and breadth about equal, minutely and distantly punctured; discal depression deep, not very large, subrotundate, its two basal punctures small; lateral foveæ deep, but hardly prolonged as far as the middle. *Elytra* oblong, slightly narrowed near the base, fully a third longer than the thorax, nearly plane, minutely and distantly punctured, and in some lights appearing feebly rugose or asperate; sutural striæ broad and deep near the base, each of the dorsal ones composed of a basal puncture and elongate impression and indistinctly prolonged to beyond the middle. *Hind body* nearly as broad as and slightly longer than the elytra, its first uncovered segment with minute brassy scales and evidently shorter than the second or following one.

*Antennæ* stout, with slender elongate pubescence; basal joint twice as long as broad, the next suboviform, as thick as the first but much shorter, third much narrower, obconical; joints 4-8 suboviform, the others broken off.

*Underside* dark red, with elongate yellow pubescence. *Metasternum* moderately elongate and convex. *Abdomen* finely punctate, segments 2-4 increasing in length, fifth little more than half as long as the fourth, sixth widely emarginate for half its length; the operculum or supplementary segment convex and broadly conical.

On comparison with its only near ally *S. lineata* (2719) this is seen to be rather larger, with coarser vestiture, and manifestly and uniformly darker in colour. The antennal tubercles are not elevated, the carina along the middle of the head is distinct, but the frontal groove is shorter and more slender. In 2719 the thoracic pubescence is decumbent, very slender, and disposed transversely, and on the middle of the second visible dorsal segment fine lines form two sides of a triangle.

♂. Length  $2\frac{1}{2}$ ; breadth nearly  $\frac{2}{3}$  mm.

Greymouth. British Museum, from Dr. Sharp's collection; one example found by Mr. R. Helms.

### 3483. *Sagola ventralis*, sp. n.

Subparallel, sanguineous, shining; pubescence yellow.

At first sight this may appear as if it were a sexual form of *S. carinata*; it is, however, a male, and exhibits the following disparities:—

The *head* is broader, less narrowed behind the eyes, with obtuse hind angles, the occipital foveæ are larger, the forehead has fine rugose sculpture, and the central carina when

inspected sideways is seen to extend right to the front, the thoracic median depression is larger and almost reaches the basal margin, though more shallow there, the intra-humeral striæ are more sharply defined as far back as the middle of the elytra, without any sign of posterior prolongation, and, what is of more importance, outside each of these there is an additional slender stria like that seen in *M. Raffray's S. frontalis*, which species, however, is materially different in other respects.

*Antennæ* as long as the head and thorax, with slender elongate greyish hairs, their basal joint hardly twice as long as broad, third obconical, nearly as long as, but more slender than, the second, joints 4-6 subequal and moniliform, seventh and eighth rather broader, ninth and tenth transverse; the basal portion of the eleventh is subquadrate, but its distinct apical appendage renders the joint conical.

*Underside* dark fusco-rufous, with yellow pubescence; abdomen finely yet distinctly and moderately closely punctured. Fourth ventral segment largest, fifth nearly as long as the second, with a broad median lobe extending nearly halfway over the much paler sixth, which is depressed at each side but its central portion is broadly conical and marginated.

This peculiar ventral structure, together with the broader head and supplementary elytral striæ, constitute the important characteristics.

♂. Length  $2\frac{1}{2}$ ; breadth fully  $\frac{1}{2}$  mm.

Greymouth (*Mr. R. Helms*). One from Dr. Sharp's collection, British Museum.

#### 3484. *Sagola occipitalis*, sp. n.

Slender, elongate, subdepressed, nitid; head and thorax light fusco-rufous, elytra and abdomen flavo-castaneous, legs and antennæ fusco-testaceous, these latter rufous near the base; palpi yellow; pubescence greyish yellow, elongate, rather thick behind, but without long erect setæ there.

*Head* suboblong-oval, not abruptly narrowed anteriorly, very slightly rounded behind the moderately large eyes, with obtuse hind angles; antennal tubercles nearly flat and separated by a distinct groove, the frontal channel moderately broad and deep and prolonged nearly to the base; the occipital foveæ very minute, hardly discernible; at each side of the base there is an indistinct transverse groove. *Thorax* slightly longer than broad, rounded and widest at or just before the middle; discal depression rather small and subrotundate, the basal punctures distinct though not large,



lateral foveæ deep but not prolonged to the middle. *Elytra* slightly depressed before the middle, indistinctly punctate, considerably narrowed towards the base, only about half as broad there as they are behind, about as long as broad and nearly double the length of the thorax; sutural striæ well marked throughout, without adjacent basal punctures, the dorsal striæ fully half the entire length, each consisting of a distinctly separated basal puncture and elongate impression. *Hind body* subparallel, almost as broad as the elytra and a third longer, indistinctly punctate, its third visible segment slightly longer than the second.

*Antennæ* rather longer than the head and thorax, with elongate pubescence; basal joint twice as long as broad, second subglobular, third not as large, joints 4-10 gradually thickened, the fourth as long but not quite as broad as the second, fifth to eighth nearly equal and moniliform, the following two transverse, the terminal conical, nearly twice the length of the penultimate.

The form of the head, its relatively large and elongate frontal channel but very minute occipital foveæ, the indefinite shape of the thorax, neither exactly cordate nor oviform, and the basally narrowed elytra render its position doubtful. At present it is located in Section XIV. of the genus.

Length  $1\frac{2}{3}$ ; breadth nearly  $\frac{1}{2}$  mm.

Greymouth. A single individual from Dr. Sharp's collection in the British Museum, found by Mr. R. Helms. It is mounted with the abdomen embedded in gum, so I have not considered it advisable to risk injury in dismounting and cleaning it to examine the structure of the underside; I think, however, it is a female.

3485. *Sagola longula*, sp. n.

Narrow, subparallel, very elongate, slightly convex, shining, with suberect, elongate, yellowish pubescence, the head and thorax nearly glabrous; dark rufous, elytra and legs paler, palpi yellow, antennæ somewhat fulvescent.

*Head* subovate, slightly narrowed behind the moderately large feebly convex eyes, with obtuse hind angles, finely punctate near the sides; antennal tubercles slightly elevated, frontal channel oblong, deep, extending as far as the middle of the eyes, occipital foveæ very distinct. *Thorax* almost oviform, being only moderately rounded and rather wider near the middle than elsewhere, slightly longer than broad; discal depression subrotundate but not very large, not reaching the base, which has two small punctures; lateral

foveæ deep, prolonged forwards to the middle. *Elytra* oblong, a third longer than broad, longer than the thorax, not perceptibly depressed near the base; sutural striæ rather narrow, finely pluripunctate, and with a basal puncture alongside each; dorsal striæ not extending as far back as the middle, each distinctly divided, the basal portion punctiform. *Hind body* rather longer but not broader than the wing-cases, somewhat transversely convex, its segments gradually increasing in length, the fourth longer and paler than the preceding one, the small fifth conical and quite exposed; the first visible segment, besides the longer pubescence, bears numerous minute brassy setæ, and, though its apex is truncate, its sides as well as the thick lateral margins are obtusely prolonged.

*Antennæ* nearly as long as the head and thorax, their last four joints rather broader than the preceding ones; basal joint red, thick, almost twice as long as broad, second slightly longer than broad, third globular, much smaller than the adjacent ones, fourth and fifth globular and equal, sixth and seventh very slightly broader, both narrowed in front, joints 8-10 transverse, the terminal one large, conical, its apical appendage distinct.

This, as regards the elytra, agrees very well with M. Raffray's description of *S. brevicornis*, but the hind angles of the head and the shape of the thorax must be very different. Unfortunately I have not seen his species, which I think is referable to another section. Although this is placed in the same section as *S. guinnessi*, it does not accord with any of its members.

Length  $2\frac{1}{2}$ ; breadth barely  $\frac{1}{2}$  mm.

Auckland. Found by Mr. T. Lawson about forty years ago. One from Dr. Sharp's collection, British Museum.

### 3486. *Sagola pallidula*, sp. n.

Nitid, wholly testaceous; pubescence elongate, greyish yellow, suberect, thicker on the abdomen, with very few long hairs.

*Head* rather shorter than the thorax, slightly narrowed behind the moderately large eyes, with obtuse hind angles; antennal tubercles a little elevated and almost contiguous at the apex, frontal channel moderately broad and deep, very gradually expanded backwards and extending as far as the back of the eyes; occipital foveæ distinct. *Thorax* subcordate, widest and rounded before the middle, of about equal length and breadth; discal depression moderately large, sub-

quadrate; basal punctures small and almost in contact with the depression; lateral foveæ deep and reaching the middle. *Elytra* oblong, a third longer than the thorax, gently narrowed towards the base, with well-marked simple sutural striæ, the dorsal stria consisting of a distinctly separated basal puncture and more elongate impression, which is quite short on one elytron but longer on the other. *Hind body* as broad and fully as long as the elytra, obliquely narrowed and depressed towards the extremity, the first uncovered segment evidently shorter than the second, which is hardly as long as the third.

*Antennæ* rather elongate and slender, longer than the head and thorax, slightly incrassate from the fourth joint onwards, with elongate pubescence; basal joint twice as long as broad, the second more than half the length of the first, somewhat obconical, third small and subglobular, joints 4-6 rather longer than broad, the next two slightly broader, ninth and tenth subquadrate, eleventh conical.

The unusually pale colour is perhaps due to immaturity. Although it should be placed in the same section of the genus as *S. prisca* (247) and its allies, its small size renders its separation from all of them a comparatively easy matter. *S. punctata* (1880), formerly the smallest of the section, is  $2\frac{1}{2}$  mm. in length, its antennæ, though relatively shorter, are considerably stouter, the tubercles are more prominent, its head is punctate, and there is a distinct puncture alongside each of the sutural striæ.

Length  $1\frac{2}{3}$ ; breadth nearly  $\frac{1}{2}$  mm.

Grey-mouth. Found by Mr. R. Helms. A single example in the British Museum from Dr. Sharp's collection is all I have seen.

3487. *Sagola spiniventris*, sp. n.

Elongate, narrowed anteriorly, subdepressed, nitid; head, thorax, and base of elytra rufous, remainder of these last of a paler red; abdomen chestnut-red; antennæ and legs rufotestaceous; tarsi and palpi flavescent; pubescence yellowish, elongate and suberect, thicker on the abdomen.

*Head* rather small, subovate, very slightly narrowed behind the rather small moderately prominent eyes, with obtuse hind angles; antennal tubercles a little elevated; frontal channel large, oviform, almost reaching the base; occipital foveæ very small. *Thorax* rather broader than the head, very slightly longer than broad, moderately rounded and widest near the middle; median depression moderately

large, of irregular form, subquadrate; basal punctures small, lateral foveæ deep, not prolonged beyond the middle. *Elytra* suboblong, distinctly narrowed before the middle, a third longer than the thorax, indistinctly punctate; sutural striæ deep throughout, with a small basal puncture alongside each, the dorsal striæ half the whole length, one with a single basal puncture, the other with two minute ones. *Hind body* rather longer than the elytra and quite as broad, its first visible segment rather shorter than either of the following two.

*Antennæ* as long as the head and thorax, evidently thickened from the fifth joint onwards, with elongate pubescence; basal joint twice as long as broad, second oviform, third of nearly similar form but only half as large, fourth subglobular, fifth rather larger than either of the following two, which are also subglobular, eighth slightly larger, ninth and tenth transversely quadrate, the terminal one conical and large.

*Underside* castaneo-rufous, with elongate yellow pubescence; segments 2-4 nearly equal, with deep sutures, fifth rather shorter, sixth hardly as long as the preceding one, slightly but widely emarginate; at one side of its extremity a slender spiniform process extends backwards, its fellow of the other side having been detached along with the gummed portion of the supplementary segment. The remaining process is visible from above after being remounted on cardboard.

The body tapers anteriorly, but interruptedly. The thorax is oviform rather than cordate, so that this species should be placed at present near *S. occipitalis*. The frontal channel is elongate-oval, and the terminal ventral segment remarkable.

♀. Length  $2\frac{1}{4}$ ; breadth  $\frac{1}{2}$  mm.

Picton. One example from Dr. Sharp's collection, British Museum, found about thirty years ago by Mr. R. Helms.

#### 3488. *Sagola grata*, sp. n.

Elongate, shining, light rufous, abdomen and antennæ pale castaneous, legs fulvescent, palpi yellow; pubescence elongate, suberect, yellowish grey.

*Head* nearly as large as the thorax, obliquely narrowed anteriorly, its sides behind the moderately large eyes nearly straight, with rounded hind angles; it is finely and irregularly punctate, rather more distinctly on the somewhat flattened tubercles; frontal channel deep, extending to beyond the back of the eyes, narrower in front than behind, occipital foveæ distinct. *Thorax* subcordate, strongly rounded and widest near the middle, as much narrowed in front as behind,



minutely and distantly punctate; discal depression large, subrotundate, basal punctures small, lateral foveæ deep, hardly attaining the middle; its length and breadth about the same. *Elytra* distinctly narrowed before the middle, as long as they are broad, a third longer than the thorax; sutural striæ deep, with a small basal puncture alongside each; the dorsal striæ divided, each having a basal puncture and elongate impression, which is feebly prolonged beyond the middle. *Hind body* rather longer than the wing-cases, first visible segment rather shorter than the following ones and bearing minute brassy scales.

*Antennæ* as long as the head and thorax, very gradually incrassate from the fourth joint onwards; basal joint twice as long as broad, second rotundate, third small and oviform, joints 4-7 rather broader than long, each narrowed towards the extremity, 8-10 laxly articulated, transverse, the terminal joint quadrate, but with an additional apical appendage.

*Underside* light chestnut-red, finely punctate, with elongate yellow pubescence. Head obtusely swollen near each side behind the middle, the central space concave, and with an impression near the inner side of each eye. Fifth ventral segment rather shorter than the third or fourth, sixth nearly as long as the preceding one in the middle, deeply but narrowly emarginate behind, the operculum rather small and subovate.

This is certainly distinct from *S. spiniventris*, the head is broader and its sculpture, both above and below, is quite different.

♂. Length  $2\frac{1}{5}$ ; breadth  $\frac{1}{2}$  mm.

Picton. Found by Mr. Helms. A specimen of this species, found on cardboard alongside one of *S. spiniventris* in Dr. Sharp's collection, has been returned to the British Museum.

### 3489. *Sagola bifoveiceps*, sp. n.

Elongate, shining, head and thorax light rufous, elytra, legs and antennæ more fulvescent, abdomen light castaneous, palpi yellow.

This species most nearly resembles *S. grata*, from Picton, but on comparing the two the following differences become apparent:—

*Head* rather narrower, distinctly narrowed behind, frontal channel large, deep, broader in front than behind and almost reaching the base, antennal tubercles more elevated and more evidently separated, occipital foveæ almost minute but

sharply marked. *Elytra* suboblong, gradually narrowed and depressed above before the middle, fully a third longer than the thorax; sutural striæ deep, punctiform at the base, but without distinct basal punctures alongside, dorsal striæ not prolonged beyond the middle. *Hind body* slightly longer than the elytra, its first visible segment evidently shorter than either of the following two, with minute brassy scales at its base and numerous short setæ behind, the terminal two segments horizontal.

*Antennæ* slightly longer than the head and thorax, their second joint suboviform, third small and globular, joints 4-8 about equal, each narrowed apically, ninth and tenth moderately transverse, slightly broader than the eighth, the terminal one larger, conical.

*Underside* chestnut-red, fulvescent behind. Head red, with a pair of semicircular depressions between the eyes. Prosternum subtruncate in front (in most species it is distinctly emarginate). Ventral segments 2-4 gradually enlarged, the fifth as long as the fourth at the sides, sixth narrow, with an elongate central fovea.

♂. Length  $2\frac{1}{3}$ ; breadth  $\frac{1}{2}$  mm.

Greymouth (*R. Helms*). British Museum, one from Dr. Sharp's collection.

3490. *Sagola biimpressa*, sp. n.

Shining, light rufous, abdomen and legs slightly castaneous, antennæ obscurely fulvescent, palpi yellow; the pubescence elongate (most of it rubbed off).

*Head* rather broad, slightly narrowed behind the moderately large and prominent eyes, with obtuse hind angles; frontal channel deep, prolonged nearly to the base but becoming narrower there, occipital foveæ small, antennal tubercles slightly elevated. *Thorax* subcordate, widest and rounded at the middle, of about equal length and breadth; discal depression subquadrate, basal punctures small, lateral foveæ deep, extending nearly to the middle. *Elytra* oblong, slightly narrowed in front of the middle, a third longer than the thorax; sutural striæ well marked, with a basal puncture near each, the dorsal striæ deep, not extending beyond the middle, each composed of a basal puncture and elongate impression. *Hind body* a third longer than the elytra, slightly wider in line with the third segment, which equals the second in length, the first shorter, with minute brassy setæ, the fourth much narrowed towards the extremity, the fifth very small.

*Antennæ* as long as the head and thorax, basal joint twice as long as broad, second suboviform, the next small and subglobular, joints 4-8 subequal, each narrowed in front, ninth and tenth slightly broader, transverse, eleventh conical.

*Underside* castaneo-rufous, with yellowish pubescence. Head with a broad lunate impression between the eyes. The third and fourth ventral segments rather longer than the second, the fifth rather shorter than the fourth, longitudinally impressed on the middle, the sixth deeply emarginate, its central portion concave along the middle, but not extending as far back as the extremity of the last dorsal segment.

Though this, at first sight, may seem to be only a sexual form of *S. bifoveiceps* it is certainly distinct and of the same sex. The head is evidently broader, its frontal channel is less cuneiform, the elytra are longer and less narrowed towards the base, the abdomen is more elongate, and the sexual characters of the underside are materially different.

♂. Length  $2\frac{1}{2}$ ; breadth quite  $\frac{1}{2}$  mm.

Greymouth (*R. Helms*). One from Dr. Sharp's collection, in the British Museum.

3491. *Sagola clavatella*, sp. n.

Elongate, narrow, subparallel, nitid; head and thorax red, elytra castaneo-rufous, abdomen, legs and antennæ less rufescent, palpi yellow; pubescence yellowish, elongate, suberect, thicker behind than in front.

*Head* subquadrate behind the nearly flat antennal tubercles, the genæ almost straight, with obtuse hind angles, very finely and irregularly punctate; frontal channel deep, oblong, extending as far as the back of the eyes, but hardly half as wide between the tubercles, occipital foveæ small and punctiform. *Eyes* moderately large. *Thorax* rounded and widest at the middle and therefore not quite cordate, its length and breadth about equal; discal depression subrotundate basal punctures small but distinct, lateral foveæ deep, not prolonged beyond the middle, its surface minutely and indistinctly punctured. *Elytra* oblong, a third longer than the thorax, slightly narrowed before the middle, nearly flat above; sutural striæ well marked, with a basal puncture close to each, the dorsal striæ composed of a basal puncture and an elongate impression which becomes narrower and less distinct behind the middle. *Hind body* horizontal, a third longer than the elytra, its first visible segment with minute brassy

scales, rather shorter than either of the next two, the terminal two conjointly as long as the third and subtriangular.

*Antennæ* as long as the head and thorax, distinctly pubescent, more thickly towards the extremity; basal joint twice as long as broad, the next two subglobular, the third much smaller, joints 4-6 about equal, all narrowed towards the apex and slightly longer than broad, seventh and eighth of similar form but rather broader, tenth rather larger than the ninth, both transverse and broader than the preceding one, eleventh quadrate but with an additional apical appendage.

*Underside* light chestnut-red, coxæ flavescent; segments 2-4 increasing in length, fifth subtruncate behind, sixth conical, semicircularly emarginate, the operculum subrotundate.

From all its allies of equal size this is differentiated by the horizontal abdomen, details of sculpture, and the subclavate antennæ. The indefinite shape of the thorax, neither distinctly cordate nor oviform, necessitates its being placed at present near *S. auripila* (3371), from which, however, it is abundantly distinct.

♂. Length  $2\frac{1}{2}$ ; breadth  $\frac{1}{2}$  mm.

Grey-mouth (*Helms*). One from Dr. Sharp's collection, in the British Museum.

#### 3492. *Sagola lawsoni*, sp. n.

Elongate, shining, head and thorax light fusco-rufous, elytra, legs, and antennæ nearly rufo-testaceous, tarsi and palpi yellow; pubescence yellowish, elongate and suberect.

*Head* rather short and broad, with rounded hind angles, the genæ not narrowed behind the moderately large eyes; antennal tubercles distinctly elevated, frontal channel broad, extending as far as the back of the eyes, occipital foveæ moderately large but not widely separated, finely punctate near the sides. *Thorax* cordate, slightly broader than the head, of about the same length and breadth, with some fine punctures near its sides; median depression subquadrate, basal punctures distinct but not large, lateral foveæ deep and prolonged to the middle. *Elytra* oblong, very slightly narrowed before the middle; sutural striæ well marked, finely punctate near the base, the dorsal striæ divided, not extending beyond the middle, with two, or only a single basal puncture. *Hind body* not longer than the wing-cases, second and third segments equal, the basal one much shorter and bearing minute brassy scales, the terminal two paler and somewhat deflexed.

*Antennæ* as long as head and thorax, moderately slender,



slightly thickened towards the extremity, with slender out-standing hairs; basal joint red, its length double the breadth, second oviform, third small and subglobular, fourth slightly longer than broad, joints 5-7 about equal, narrowed in front, the eighth of similar form but slightly shorter and broader, tenth transverse, slightly broader than the ninth, eleventh conical.

*Underside* castaneo-rufous, with slender, greyish pubescence. Ventral segments 2-4 increasing in length, fifth and sixth simple.

This differs from *S. sobrina* (1877) in being less robust and narrower, with more oblong and differently sculptured elytra, &c. The frontal channel, though reaching the back of the eye, appears relatively short in comparison with other species, owing to the form of the head itself.

Length  $2\frac{1}{3}$ ; breadth  $\frac{1}{2}$  mm.

Auckland. Sent to Dr. Sharp about forty years ago by Mr. T. Lawson, whose name has been given to it. One example in the British Museum.

The peculiar vestiture of the first uncovered dorsal segment is almost invariably an indication of the male, but, after spending a couple of hours in removing the specimen from the card and cleaning the underside as well as possible, I failed to detect other male characters, so it is probably a female.

3493. *Sagola latula*, sp. n.

Nitid, rather broad; rufous, abdomen, legs, and antennæ light chestnut-red; pubescence yellow, very scanty on the head and thorax.

*Head* as large as the thorax, broad, with rounded hind angles; antennal tubercles slightly elevated and finely punctured; frontal channel deep and broad, somewhat expanded near the middle, extending almost as far as the back of the eyes and, when looked at from the side, apparently prolonged as a slender groove to the base; occipital foveæ distinct and somewhat elongated. *Thorax* rather broader than long, widest and rounded near the front, with a few minute punctures; discal depression subquadrate, basal punctures small but distinct, lateral foveæ deep and extending forwards to the middle. *Elytra* of about equal length and breadth, slightly narrowed near the base, a third longer than the thorax; they are finely and irregularly punctate, and a little depressed before the middle; sutural striæ deep and broad, with a basal puncture alongside, the dorsal striæ with a basal puncture and elongate impression (longer on one elytron than on the other). *Hind body* as broad as the elytra but a third

longer, its first uncovered segment simple and rather shorter than either of the following two.

*Antennæ* with some very elongate hairs; basal joint twice as long as broad, third obconical, narrower than the second but nearly as long; joints 4-7 differing but little, each slightly longer than broad, the eighth rather shorter, the next two transverse, the terminal conical, including its distinct apical appendage.

*Underside* nitid. Head rather thickly pubescent behind, smooth and unimpressed near the hind angles, flat between the eyes, but with slightly curved and distinctly thickened hind borders; in front, behind the mentum, there is a transverse fovea. Metasternum short, slightly impressed behind the middle. Abdominal segments: third and fourth nearly equal, largest; fifth nearly as long, truncate behind in the middle; sixth broadly conical, flat, not reaching the extremity but without any well-marked apical suture.

Allied to *S. laticeps* (3362), but the whole insect is broader and the head is less trigonal. In 3362 the hind angles are directed slightly outwards; in this species they are rounded, and the sculpture underneath also differs. The elytra are larger and less narrowed towards the base.

Length  $2\frac{2}{3}$ ; breadth  $\frac{3}{4}$  mm.

Grey-mouth (*Helms*). A single specimen from Dr. Sharp's collection in the British Museum.

Most of the pubescence has been rubbed off and most likely the minute squamæ on the first exposed dorsal segment disappeared along with it. The real structure of the terminal ventral segment is obscured by gum, but the sculpture of the underside of the head denotes the male. In any case, when placed side by side with *S. laticeps* it is seen to be distinctly different from it.

LXXVIII.—*The Anatomy and Classification of the Teleostean Fishes of the Order Discocephali* \*. By C. TATE REGAN, M.A.

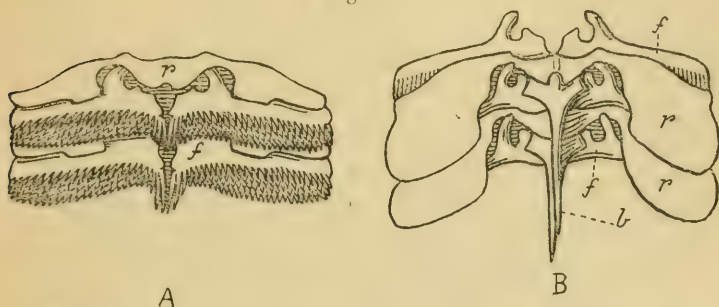
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THE order Discocephali differs from the Percoids especially in the remarkable transformation of the spinous dorsal fin into a flat, oval, transversely laminated, adhesive disc, which

\* On the structure of the adhesive disc cf. Beck, 'Die Haftscheibe der *Echeneis remora*,' Schaffhausen, 1879; and Storms, Ann. & Mag. Nat. Hist. (6) ii. 1888, p. 67. For a discussion of the systematic position of the group cf. Gill, in Jord. & Everm. Bull. U.S. Nat. Mus. xlvii. 1898, pp. 2265-2268.

extends forward on the upper surface of the head. The spines are shortened, depressed backwards, and expanded transversely to form pairs of broad flat laminae which are denticulated posteriorly; in the middle line posterior projections of each pair of laminae are connected by ligament, and a low fin-membrane joins them to the next pair. This is the structure in the Echeneididae; in the Eocene Opisthomyzonidae the laminae were not nearly so broad and the median projection seems to have been stronger and undivided.

Fig. 1.



*Remora remora*. Segments of disc from above (A) and below (B).  
*f*, fin-ray; *r*, radial; *b*, basal.

The small lateral expansions of the radials seen in most Percoids have become large overlapping laminae in the Echeneididae; the basalia are nearly normal, except that they are directed very obliquely backwards.

It is difficult to imagine the initial stages of this extraordinary modification, but it seems not impossible that some pelagic Percoid with the habit of associating with sharks, like the pilot-fish (*Naucrates*), should have found that the spinous dorsal fin, when depressed in its groove, could be used more or less effectively as an adhesive organ, and should have acquired the habit, when swimming close to its protector, of fastening on.

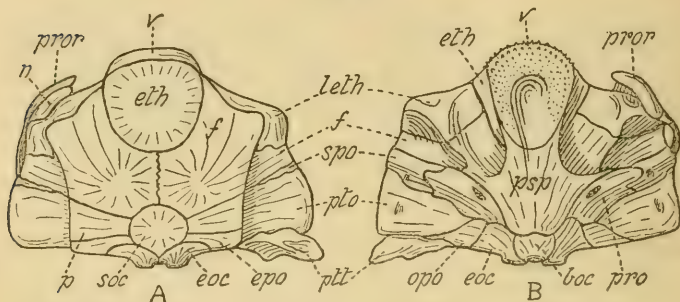
The other fins are very similar to those of the Pomatomidae, Carangidae, Rhachicentridae, &c., in structure and position, and the Discocephali may well have evolved from Percoids of this type.

The most important characters of the Discocephali, in addition to the peculiar structure of the dorsal fin, are the following:—

Mouth not protractile, with the slender maxillary firmly adherent to the præmaxillary; dentary attached to articulare

only at the anterior end of the latter, capable of a certain amount of independent movement. Palatine elongate, attached by its upper edge to the lateral ethmoid; pterygoid and mesopterygoid ankylosed; suspensorium, branchial, and opercular bones otherwise typically Percoid. Skull broad, very strongly depressed, with flat or concave upper surface; basisphenoid and alisphenoids absent; exoccipital condyles transversely expanded, wide apart; nasal and præorbital firmly united to each other and to the lateral ethmoid; number and arrangement of other bones of skull as in the

Fig. 2.



*Remora clypeata.* Skull from above (A) and below (B).

*v*, vomer; *eth*, mesethmoid; *leth*, lateral ethmoid; *pror*, præorbital; *n*, nasal; *f*, frontal; *p*, parietal; *soc*, supraoccipital; *ex*, exoccipital; *boc*, basioccipital; *epo*, epiotic; *opo*, opisthotic; *pto*, pterotic; *spo*, sphenotic; *pro*, prootic; *psp*, parasphenoid; *ptt*, post-temporal.

Perciformes. Vertebrae 23 to 30; ribs and epipleurals inserted together on strong transverse processes. Pectoral arch of the Perciform type, except that the supracleithrum is reduced and 3 radials are in contact with the hypocoracoid; pelvic bones directly attached to the cleithra.

Two families may be recognized:—

### Family 1. *Opisthomyzonidae*.

Disc of about 6 segments, small, narrow, not extending forward to the interorbital region, its width about  $\frac{1}{3}$  the width of head. Vertebrae 23 or 24. Dorsal fin longer than anal; caudal widely forked.

*Opisthomyzon glaronensis* from the Upper Eocene of Switzerland (Wettstein, Mem. schweiz. Palæont. Ges. xiii. 1886, p. 82, pl. vii. fig. 10; Storms, Ann. & Mag. N. H. (6) ii. 1888, p. 73; Cope, Amer. Nat. xxiii. 1889, p. 355).



The small disc, the broad opercles, the form of the caudal fin, &c. indicate that this was a more active swimmer than the modern fishes of the order.

### Family 2. Echeneididæ.

Disc of 10 to 30 segments, large, extending forward to the snout, nearly as broad as the head. Vertebrae 26 to 30. Dorsal fin as long as anal; caudal truncate or emarginate.

About 10 recent species\* belonging to two genera, *Echeneis* and *Remora*, the largest species, *E. naucrates*, attaining a length of about 3 feet. Carnivorous fishes of warm seas, attaching themselves by means of their adhesive disc to large fish or other marine animals, or to ships.

## LXXIX.—*The Caristiidæ, a Family of Berycomorphous Fishes.* By C. TATE REGAN, M.A.

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IN 1905 (Proc. Biol. Soc. Washington, xviii. p. 249) Gill and Smith described a remarkable fish obtained in the market at Kagoshima as a new genus and species, *Caristius japonicus*, the type of a new family of jugular acanthopterygians; the specimen was figured by Smith and Pope (Proc. U.S. Nat. Mus. xxxi. 1906, p. 491, fig. 10).

In 1911 (Rés. Camp. Sci. Monaco, xxxv. p. 101, pl. v. fig. 5) Zugmayer described and figured *Platyberyx opalescens* as a new genus and species, known only from a single specimen taken in deep water to the south of Cape St. Vincent.

A comparison of the descriptions and figures leaves no doubt that these two fishes are closely related, probably congeneric and perhaps not specifically distinct. The number of fin-rays is not quite the same, 34 dorsal and 21 anal in the Japanese specimen, 31 dorsal and 18 anal in the Atlantic one. As the former was in poor condition, not much importance can be attached to the supposed absence of the lateral line, which is well developed in the latter.

Zugmayer places his fish in the Berycidæ (*s. l.*) on account

\* Günther, Ann. & Mag. Nat. Hist. (3) v. 1860, p. 389, or Cat. Fish. ii. p. 376.

of its form, the muciferous channels on the head, the large eye, and the oblique mouth, and in spite of the fact that the pelvic fin is formed of a spine and only 5 branched rays. I have little doubt that he is right, and that the family Caristiidæ belongs to the Berycomorphi, for the caudal fin has spinous procurent rays and include 19 principal rays, 17 branched (*vide* Gill & Smith), as in typical Berycoids. In the Percomorphi there are not more than 17 principal rays (15 branched) and the number may be much less in the more specialized members of the order.

The Caristiidæ seem to be nearest to the Diretmidæ\*, differing from them in the cycloid scales, the longer dorsal fin commencing above the middle of the eye, the pelvic fins more anteriorly placed, with normal spines and folding into a ventral groove, the narrower maxillary (? without supra-maxillary), and the toothed palate. The vertebræ number about 40, as shown by a radiograph of *C. japonicus*.

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LXXX.—*New Centronycteris and Ctenomys from  
S. America.* By OLDFIELD THOMAS.

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*Centronycteris centralis*, sp. n.

Nearly allied to *C. maximiliani*, but slightly larger, colour rather darker, and basi-sphenoid pits of skull markedly shorter.

Fur long and loose; hairs of back about 6·5 mm. in length. General colour above dark tawny brown, that of a Para example of *C. maximiliani* somewhat paler. Basal third of interfemoral well clothed with long hairs.

Skull decidedly larger than that of *C. maximiliani*, its general structure as in that species, with the exception that the basi-sphenoid pits are much shorter, not longer than broad and not extending forwards between the pterygoids; their length is 1·8 mm. in the type, as against 2·8 in *maximiliani*, where they reach forward to well between the pterygoids.

\* Cf. Ann. & Mag. Nat. Hist. (8) vii. 1911, p. 5.

Dimensions of the type :—

Forearm 45 mm.

Head and body 52 ; tail 18 ; third finger, metacarpus 46·5, first phalanx 18·5 ; lower leg and hind foot 26.

Skull : length 15 ; zygomatic breadth 10 ; palato-sinual length 5 ; front of canine to back of  $m^3$  6·1 ; breadth between outer edges of  $m^2$  6·6.

*Hab.* Bogava, Chiriqui, Panama. Alt. 250 m.

*Type.* Adult male. B.M. no. 0. 7. 11. 3. Original number 31. Collected 20th October, 1898, by H. J. Watson.

Mainly distinguishable from *C. maximiliani* by its very different basisphenoid pits.

*Ctenomys saltarius*, sp. n.

Size fairly large, about as in *Ct. opimus*. Fur rather short (about 13 mm. in length on the back) and dull in tone, having neither the length nor glossiness of that of the neighbouring species. Colour dull "raw umber" above, browner along the median dorsal area, paler on sides. Under surface dull buffy whitish. Area round snout whitish, succeeded by an inconspicuous darker collar. Feet dull white. Tail more markedly bicolor than usual, blackish above, dull white below.

Skull very narrow, the zygomatic spread less than the distance from the front of the incisors to the back of the tooth-row, markedly greater in other species. Frontal region also very narrow, the interorbital breadth less than the length of the molar series. Postorbital processes practically absent.

Dimensions of the type (measured in skin) :—

Head and body (stretched) 200 mm. ; tail 90 ; hind foot 33. Skull : front of nasals to back of frontals 34·8 ; front of incisors to back of  $m^3$  29·5 ; zygomatic breadth 28·5 ; nasals  $20 \times 7\cdot7$  ; interorbital breadth 9·2 ; palatilar length 23·8 ; diastema 15 ; upper tooth-series, crowns 10·5, alveoli 11.

*Hab.* Salta, N. Argentina.

*Type.* Adult female. B.M. no. 99. 2. 22. 26. Original number 8904. Presented by the La Plata Museum through Dr. F. P. Moreno.

The only species occurring near this are the far paler *Ct. opimus* (of which a special subspecies, *Ct. o. luteolus*, is a native of Jujuy) and the dark brown *Ch. tucumanus* of

Tucuman. Both have long glossy fur, very different in both colour and texture from that of *Ct. saltarius*, which in these respects has a superficial resemblance to the far southern *Ct. fueginus*. The bicolor tail and narrow skull are also strongly characteristic of the Salta Tuco-tuco.

LXXXI.—*A new Cynopterus from Borneo.*

By KNUD ANDERSEN.

*Cynopterus persimilis*, sp. n.

*Type*, [♂] ad., skin and skull, Sarawak, Borneo, collected by Cecil J. Brooks, Esq., B.M. 12. 10. 26. 1.

Closely allied to *C. horsfieldi lyoni*\* (Sumatra), from which it differs chiefly, or perhaps only, in the position of the surface cusp of  $p_4$  and  $m_1$  (third and fourth lower cheek-teeth).

This cusp is in *C. persimilis* situated close to the inner longitudinal ridge of the tooth, so close, indeed, that its anterior extremity is quite or very nearly in contact with the ridge (at a point a little in front of the middle of the ridge). In the numerous skulls of the allied forms of *Cynopterus* which have passed through my hands the surface cusp is either central in position or, if nearer the inner edge, quite without any connection with this latter.

Colour of fur as in *C. horsfieldi* and *harpax*. Size the same, if not a little larger:—Forearm 79.5 mm. (largest *C. h. lyoni* seen, 77.5 mm.), maxillary tooth-row ( $c-m^1$ , crowns) 12 mm.

The "*Niadius*" section of the genus *Cynopterus* was hitherto known only from the Malay Peninsula (*C. harpax*), Sumatra (*C. horsfieldi lyoni*), Java (*C. horsfieldi horsfieldi*), and Nias (*C. princeps*). But farther northward in Indo-Malaya, in the Philippine Islands, this type of fruit-bat has differentiated into a distinct genus, *Ptenochirus* (inner pair of lower incisors absent, outer pair of upper incisors shortened). The interest of the new species here described lies chiefly in the fact that it adds Borneo to the area occupied by the "*Niadius*" section of *Cynopterus*, thus filling up the distributional gap hitherto supposed to exist between this section and its Philippine representative, *Ptenochirus*.

\* Cat. Chir. i. pp. 632, 827. I take this opportunity to correct a slip of the pen on p. 631 of the Catalogue: in line 35 for "larger" read "smaller."



LXXXII.—*Sexual Differences in the Pociliid Fishes of the Genus Cynolebias.* By C. TATE REGAN, M.A.

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HERR A. RACHOW, of Hamburg, has written calling my attention to the fact that I have overlooked a paper by C. Berg (*Anales Mus. Nac. Buenos Aires*, v. 1897) when preparing my revision of the genus *Cynolebias* ('Annals,' Nov. 1912, p. 505). Berg's paper is important not only for the description of two new species, but for the conclusion that *Cynolebias bellottii* is the male and *C. maculatus* the female of one species, the difference in the number of dorsal and anal rays being a sexual character.

Herr Rachow tells me that from his own observations in the aquarium there can be no doubt that *C. maculatus* is the female of *C. bellottii*, and he has sent me some specimens in support of this. After examination of the sexual organs of all the specimens of *Cynolebias* in the collection of the British Museum, I have no doubt whatever that he is right; but I am not acquainted with any other instance in the whole class of fishes of a difference between the sexes in the number of fin-rays.

The males and females of *C. bellottii* differ as follows:—

♂ *C. bellottii*.

Brownish, sometimes with vertical series of pale spots; fins violet.

Dorsal and anal fins relatively long, low, and many-rayed.

D. 21–24, A. 26–31: dorsal origin equidistant from end of snout and base of caudal fin, behind that of anal; longest rays  $\frac{1}{2}$  to  $\frac{2}{3}$  length of head.

In consequence of the length of the anal the pectoral extends beyond its origin and the caudal peduncle is shorter than deep.

♀ *C. maculatus*.

Vertically expanded dark brown or violet spots on body and vertical fins.

Dorsal and anal fins relatively short, deep, and few-rayed.

D. 16–19, A. 22–26: dorsal origin nearer to base of caudal than to end of snout, above that of anal; longest rays  $\frac{3}{4}$  or  $\frac{4}{5}$  length of head.

The pectoral does not reach the anal and the caudal peduncle is longer than deep.

Similar differences are exhibited by the two species described by Berg; these are:—

1. *Cynolebias gibberosus*.

Berg, *Anales Mus. Nac. Buenos Aires*, v. 1897, p. 294.

♂. D. 25, A. 33; ♀. D. 17, A. 26. 37 to 40 scales in a

longitudinal series. Similar to *C. bellottii* in form and coloration in both sexes; back in front of dorsal fin arched, bearing a series of bony tubercles; head bony, with post-orbital tubercles.

Province of Buenos Aires.

Total length 85 mm.

## 2. *Cynolebias holmbergi*.

Berg, *t. c.* p. 296.

♂. D. 21, A. 25; ♀. D. 17, A. 21. At least 60 scales in a longitudinal series. Head  $3\frac{1}{3}$  to  $3\frac{1}{2}$  in length to base of caudal. Yellowish; a dark bar on the head.

Province of Buenos Aires.

Total length 300 mm.

In *C. melanotænia* the males are similar to the females both in coloration and in number of fin-rays; in this species the pelvic fins are separated by an interspace, whereas in *Cynolebias* proper they are contiguous and often united at the base. I therefore propose to make *C. melanotænia* the type of a new genus, which may be named *CYNOPÆCILUS*.

I have ascertained that the types of *C. robustus* and *C. nigripinnis* are males; the single example of *C. elongatus* in the British Museum collection has been eviscerated, but it seems probable that the two or three specimens known of this species are females, whilst the type of *C. porosus* may be a female also.

Assuming this to be the case, the number of scales in a longitudinal series, and of dorsal and anal rays in both sexes, of the species of *Cynolebias* may be tabulated as follows:—

	Scales.	♂.	♀.
<i>C. nigripinnis</i> ..	28	D. 26; A. 25	....
<i>C. bellottii</i> ....	28 to 30	D. 21-24; A. 26-31	D. 16-19; A. 22-26
<i>C. robustus</i> ....	33	D. 22; A. 24	....
<i>C. gibberosus</i> ..	37 to 40	D. 25; A. 33	D. 17; A. 26
<i>C. porosus</i> ....	40	....	D. 18; A. 20
<i>C. elongatus</i> ..	45 to 50	....	D. 17; A. 20
<i>C. holmbergi</i> ..	60	D. 21; A. 25	D. 17; A. 21

# INDEX to VOL. X.

- ACANTHICOLEPIS** *asperrima*, note on, 173.  
**Acanthoplesiops**, characters of the new genus, 266.  
**Acidaliodes**, new species of, 509.  
**Agallia**, new species of, 607.  
**Agapostemon**, new species of, 24.  
**Agaristidæ**, new African, 609.  
**Agathodes**, new species of, 562.  
**Aglymbus**, new species of, 433.  
**Agriomyia**, new species of, 48.  
**Aleis**, new species of, 236.  
**Alestes**, new species of, 601.  
**Amberbakia**, characters of the new genus, 443.  
**Ammatomus**, new species of, 374.  
**Ammomanes deserti**, new subspecies of, 230.  
**Amphicranus**, new species of, 245.  
**Amphidromus**, new species of, 415.  
**Amphilius**, new species of, 602.  
**Amphimetra**, new species of, 31.  
**Amplex**, new species of, 367.  
**Anapalta**, new species of, 303.  
**Andersen, K.**, on eight new *Petalia*, 546; on a new *Cynopterus* from Borneo, 640.  
**Anisodes**, new species of, 292.  
**Annelida Polychæta** from the North Sea, report on, 165.  
**Anomala**, new species of, 327.  
**Anomis**, new species of, 532.  
**Antarchæa**, new species of, 525.  
**Anthophora**, new species of, 22.  
**Antinoë**, remarks on species of, 177.  
**Aphægocera**, new species of, 611.  
**Apherusa jurinei**, note on, 600.  
**Apicia**, new species of, 232.  
**Apodes**, on the osteology and classification of the, 377.  
**Arachnida**, new, 63.  
**Argidia**, new species of, 518.  
**Ärnäck-Christie-Linde, Dr.**, errata to paper by, in the June number, 264.  
**Arrow, G. J.**, on new Burmese species of *Anomala*, 327.  
**Asilidæ** of Australasia, revision of the, 142, 350.  
**Asteroidea**, on self-evisceration in the, 282.  
**Astyochia**, new species of, 239.  
**Atherurus**, new subspecies of, 590.  
**Augochlora**, new species of, 315.  
**Austen, E. E.**, on a new species of *Tabanus* from German E. Africa, 240.  
**Austrostigmus**, characters of the new genus, 55.  
**Azya**, new species of, 320.  
**Bagnall, R. S.**, on the classification of the *Thysanoptera*, 220.  
**Baniana**, new species of, 531.  
**Barania**, characters of the new genus, 76.  
**Bathycelia**, new species of, 604.  
**Bathypogon**, new species of, 154.  
**Batrachians**, new, 140, 185.  
**Bembex**, new species of, 57, 371.  
**Bergroth, E.**, on new or little-known Ethiopian hemiptera, 191.  
**Birds**, new, 230, 262; notes on Guiana, 261.  
**Blarinella**, new species of, 400.  
**Blechroma**, new species of, 288.  
**Blennioid fishes**, on the classification of the, 265.  
**Bolton, H.**, on insect-remains from the Midland and S.-Eastern coal-fields, 161.  
**Bombus**, new species of, 21.  
**Books**, new:—Morley's Revision of the Ichneumonidæ, pt. 1, 160; Records of the Indian Museum, 161; Memoirs of the Department of Agriculture in India, 263; recent Foreign and Colonial Natural History periodicals, 460, 555; Records of the Western Australian Museum and Art Gallery, 556; Scharff's Distribution and Origin of Life in America, 556.  
**Bothriceps**, on the lower jaw of, 585.

- Botyodes, new species of, 3.  
 Boulenger, G. A., on three new African cichlid fishes, 138; on new African batrachians, 140; on new batrachians from S. America, 185; on a new cichlid fish from the Lower Niger, 263; on new reptiles from S. America, 420; on two new fishes from the Nile system, 601.  
 Brabourne, Lord, notes on Guiana birds, 261.  
 Bromeliaceæ, on the fauna of, 424.  
 Broun, Major T., on some New Zealand Pselaphidæ and on new species of Sagola, 621.  
 Bufo, new species of, 186.  
 Buist, T. P., on the development of the pectoral girdle in the pipefish, 613.  
 Cænohalictus, new species of, 317.  
 Calman, Dr. W. T., on a terrestrial amphipod from Kew Gardens, 132.  
 Calymniodes, new species of, 509.  
 Cambogia, new species of, 299.  
 Campometra, new species of, 511.  
 Capitellidæ, on the British, 124; on the, procured by the 'Porcupine,' 127.  
 Capnodes, new species of, 523.  
 Caristiidæ, note on the, 637.  
 Caura, new species of, 88.  
 Ceneus, new species of, 194.  
 Centronycteris, new species of, 638.  
 Cephalodiscus nigrescens, remarks on specimens of, 550.  
 Ceratocoris, new species of, 191.  
 Ceratothripidæ, characters of the new family, 222.  
 Cerceris, new species of, 370.  
 Certima, new species of, 234.  
 Chæronycteris, new species of, 403.  
 Characidæ, on some S.-American, 387.  
 Chaubattiana, characters of the new genus, 603.  
 Chloritis, new species of, 415.  
 Chodsigoa, new species of, 399.  
 Chubb, C., notes on Guiana birds, 261.  
 Cistugo, characters of the new genus, 205.  
 Clariola, new species of, 358.  
 Clark, A. H., on new crinoids from the Dutch East Indies, 31.  
 Clausilia, new species of, 415.  
 Cleontes, new species of, 90.  
 Cockerell, T. D. A., descriptions and records of bees, 21, 311, 484.  
 Codula, notes on species of, 149.  
 Cœlioxys, new species of, 23.  
 Coleoptera, new, 245, 250, 320, 327, 433, 621.  
 Colgan, N., on self-evisceration in the Asteroidea, 282.  
 Colomys, new species of, 42.  
 Concana, new species of, 514.  
 Copeina, new species of, 393.  
 Coremia, new species of, 302.  
 Corna, new species of, 531.  
 Corydoras, revision of the S.-American species of, 209; new species of, 211.  
 Cribella oculata, on self-evisceration in, 282.  
 Crinoids, new, 31.  
 Crocidura, new species of, 589.  
 Crossotarsus, new species of, 249.  
 Crustacea, new, 84, 132, 206.  
 Cryptognatha, new species of, 321.  
 Ctenomys, new species of, 639.  
 Cyclonotum, new species of, 435.  
 Cyclophorus, new species of, 417.  
 Cyclotus, new species of, 417.  
 Cylometra, new species of, 35.  
 Cynodontia, on the lower jaw of, 579.  
 Cynolebias, new species of, 506; on sexual differences in the genus, 641.  
 Cynopœcilus, characters of the new genus, 642.  
 Cynopterus, new species of, 640.  
 Dagassa, new species of, 519.  
 Damarius, new species of, 89.  
 Dasyproctus, new species of, 60.  
 Dawkins, Prof. W. B., on the range of the S.-Eastern coalfield, 162.  
 Decametra, new species of, 36.  
 Deromyia, new species of, 142.  
 Dialictus, new species of, 318.  
 Dichromatopodia, new species of, 298.  
 Dichrometra, new species of, 34.  
 Dicynodon, on the lower jaw of, 575.  
 Diptera, new, 142, 203, 224, 240, 356.  
 Discocephali, on the anatomy and classification of the, 634.  
 Discoscelis, new species of, 260.  
 Distant, W. L., descriptions of Ethiopian rhynchota, 87; on a new bromeliadiculous Microvelia,



- 437; on some new homoptera, 438; rhynchotal notes, 602.
- Dolichoneura*, new species of, 309.
- Dolichurus*, new species of, 365.
- Dollman, G., on a new elephant shrew from Zanzibar, 130.
- Drake-Brockman, R. E., on two new mongooses from Somaliland, 612.
- Durgades, characters of the new genus, 608.
- Dysodonta, definition of the new subordinal name, 104.
- Eaton, Rev. A. E., on a new species of *Oligoneuria*, 243.
- Ecacanthothripidae*, characters of the new family, 222.
- Edalorhina*, new species of, 190.
- Edocla*, new species of, 197.
- Edwards, F. W., on a new *Mycetophilid* from Trinidad, 203.
- Elecussa*, new species of, 531.
- Empelathra*, new species of, 519.
- Eozoon, on, 341, 446.
- Epactiothynnus*, new species of, 535.
- Epedanus*, new species of, 78.
- Epeolus*, new species of, 487.
- Ephemeridae*, new, 243.
- Epimys*, new subspecies of, 593.
- *æta*, note on, 43.
- Eriopygidia*, new species of, 305.
- Eteone depressa*, on, 119.
- Eueranta villosa*, note on, 181.
- Euneomys*, new species of, 410.
- Eunoa, remarks on species of, 169.
- Euryaspis*, new species of, 193.
- Euthermesia*, new species of, 520.
- Evarne, remarks on species of, 174.
- Everettia*, new species of, 414.
- Exomalopsis*, new species of, 319.
- Felis*, new subspecies of, 44, 325.
- Fishes, new, 138, 211, 263, 323, 391, 502, 595, 601; on the classification of the blennioid, 265; on the anatomy and classification of the teleostean, of the order *Lyomeri*, 347, of the order *Apodes*, 377; revision of S.-American characid, 387; revision of the *pœciliid*, of the genera *Rivulus*, &c., 494; on the anatomy and classification of the teleostean, of the order *Discocephali*, 634.
- Geological Society, proceedings of the, 161.
- Glyphodes*, new species of, 562.
- Gnathoprosopis*, new species of, 489.
- Goniorhynchus*, new species of, 1.
- Gonopsis*, new species of, 89.
- Gorgonia verrucosa*, on, from the English Channel, 479.
- Gorytes*, new species of, 57, 375.
- Grison*, new subspecies of, 47.
- Gudaba*, new species of, 439.
- Haas, Dr. F., on new land and fresh-water shells from the Malay archipelago, 412.
- Haddon, Miss K., on *Hersilia Vancouverensis*, 84.
- Halictus*, new species of, 485.
- Hemiptera*, new species of, 299.
- Hampson, Sir G. F., on new species of *Pyrilidae* of the subfamily *Pyraustinae*, 1, 557; on new *African Agaristidae*, 609.
- Haranga, new species of, 445.
- Harmothoe*, remarks on species of, 173.
- Hartert, E., on a new desert-lark from the Sahara, 230.
- Helodes*, on bromeliadiculous larvæ of, 431.
- Helogale*, new subspecies of, 612.
- Hemeroblemma*, new species of, 513.
- Hemiplecta*, new species of, 412.
- Hemithynnus*, new species of, 536.
- Hermiodes*, new species of, 515.
- Hersilia*, new species of, 84.
- Heterenchelidae*, characters of the new family, 382.
- Heterenchelys*, characters of the new genus, 323.
- Heterophyra*, new species of, 297.
- Heteroptera*, new, 87, 191, 437, 602.
- Heterothripidae*, characters of the new family, 222.
- Hirst, S., on new *Phalangodidae*, 63.
- Histeridae*, new, 250.
- Hololepta*, new species of, 253.
- Homalopteryx*, new species of, 431.
- Homoptera*, new, 438, 605.
- Homoptera*, new species of, 510.
- Homopyralis*, new species of, 525.
- Hyla*, new species of, 185.
- Hylambates*, new species of, 141.
- Hylixelus*, new species of, 190.
- Hylodes*, new species of, 187.
- Hymenoptera*, new, 21, 48, 311, 361, 472, 484, 533.
- Hypogramma*, new species of, 513.
- Ibalonius*, new species of, 68.
- Idiocerus*, new species of, 605.
- Isochromodes*, new species of, 234.
- Isogona*, new species of, 523.

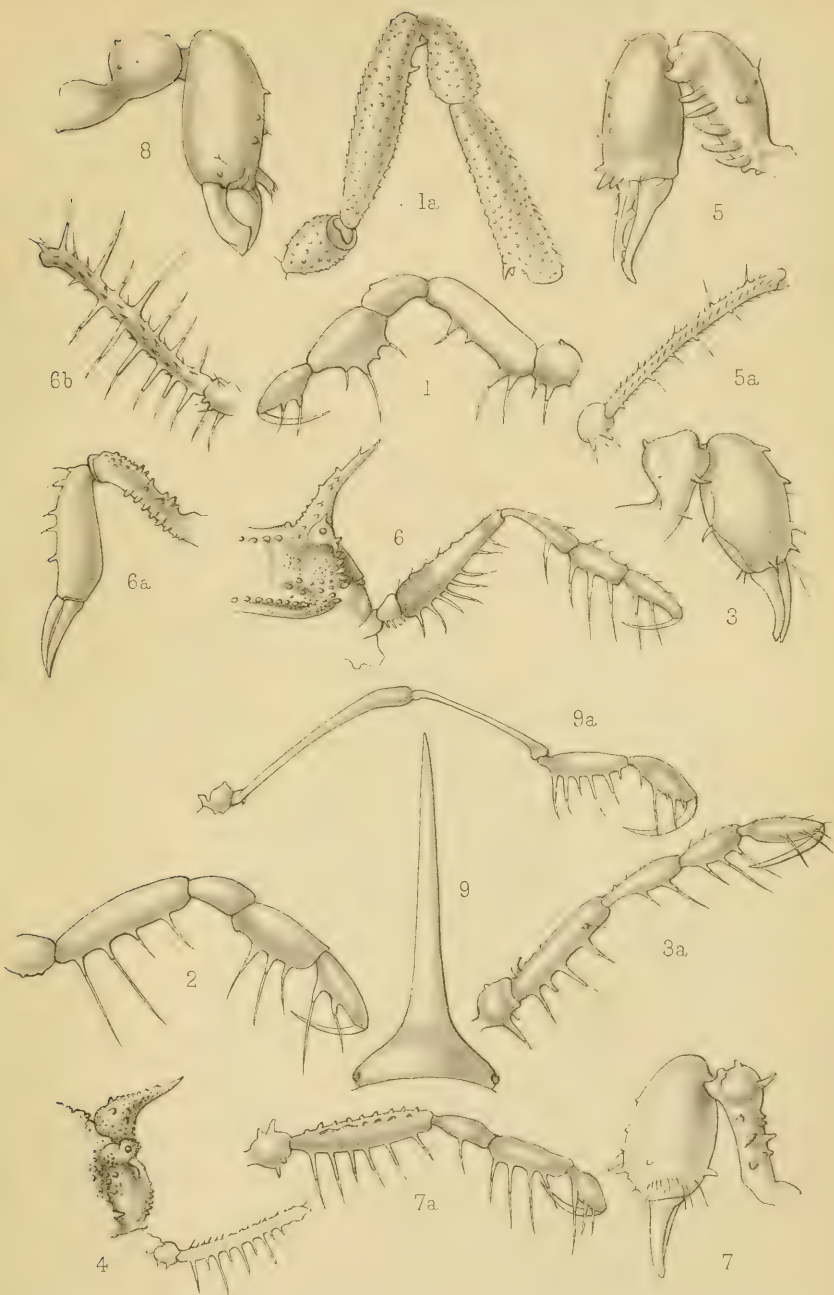
- Kerivoula, new species of, 41, 281.  
 Kirkpatrick, R., on the Stromatoporoidea and Eozoon, 341, 446.  
 Labeo, new species of, 597.  
 Lachesis, new species of, 423.  
 Lagisca, remarks on species of, 171.  
 Lagochilus, new species of, 417.  
 Ledrotypa, characters of the new genus, 442.  
 Leiothylnus, new species of, 534.  
 Leontocebus, new subspecies of, 44.  
 Lepidoptera, new, 1, 231, 286, 509, 557, 609.  
 Leptognathus, new species of, 422.  
 Leptolopha, new species of, 292.  
 Leptopoma, new subspecies of, 418.  
 Leptothylnus, new species of, 542.  
 Lethæus, new species of, 195.  
 Leucula, new species of, 238.  
 Lewis, G., on new species of Histridæ, 250.  
 Limnæa, new species of, 416.  
 Lygistorrhina, new species of, 203.  
 Lygropia, new species of, 19, 557.  
 Lyomeri, on the anatomy and classification of the, 347.  
 Mabusana, characters of the new genus, 602.  
 McIntosh, Prof., on a white porpoise, 117; on the spawning of the hake, 118; on Eteone depressa, Mgrn., 119; on Nereis zonata in Britain, 122; on the British Capitellidæ, 124; on the Capitellidæ procured by H.M.S. 'Porcupine,' 127.  
 Macrolyrcea, new species of, 235.  
 Macrotristria, new species of, 438.  
 Mammals, new, 41, 44, 130, 131, 204, 228, 280, 325, 396, 403, 546, 588, 589, 613, 638, 640.  
 March, M. C., on the classification of the Pelecypoda, 91.  
 Mariametra, new species of, 32.  
 Marshall, G. A. K., on new neotropical Coccinellidæ, 320.  
 Meade-Waldo, G., notes on the Apidæ in the British Museum, 461.  
 Megachile, new species of, 24, 472, 486.  
 Melanoides, new species of, 419.  
 Melipona, new species of, 315.  
 Melissodes, new subspecies of, 28.  
 Merluccius merluccius, on the spawning of, 118.  
 Metalaphria, characters of the new genus, 356.  
 Metanema, new species of, 232.  
 Microgonia, new species of, 233.  
 Microvelia, new species of, 437.  
 Mollusca, new, 412.  
 Mulelocha, new species of, 520.  
 Mungos, new species of, 280, 588.  
 Myrochea, new species of, 87.  
 Nanina, new species of, 413.  
 Nasua, new species of, 228.  
 Nemachilus, new species of, 598.  
 Nereis zonata in Britain, on, 122.  
 Neritina, new species of, 418.  
 Nesalcis, new species of, 238.  
 Neuroptera, new, 243.  
 Nipteria, new species of, 239.  
 Nomada, new species of, 484.  
 Nomia, new species of, 491, 493.  
 Nymphon, new species of, 207.  
 Obroatis, new species of, 517.  
 Ochotona, new subspecies of, 403.  
 Oligodonta, definition of the new subordinal name, 104.  
 Oligometra, new species of, 40.  
 Oligoneuria, new species of, 243.  
 Oospila, new species of, 287.  
 Orsa, new species of, 523.  
 Orthoptera, new, 431.  
 Oxydia, new species of, 234.  
 Pachycrærus, new species of, 258.  
 Panchætothripidæ, characters of the new family, 222.  
 Parabiantes, characters of the new genus, 82.  
 Paradoxurus, new subspecies of, 131.  
 Pariasaurus, on the lower jaw of, 582.  
 Pelecypoda, on the classification of the, 91.  
 Pelmatochromis, new species of, 263.  
 Pelorurus, new species of, 259.  
 Penthimia, new species of, 444.  
 Perizoma, new species of, 304.  
 Petalia, new species of, 546.  
 Petalocephala, new species of, 441.  
 Petalochirus, new species of, 198.  
 Phalangodidæ, new, 63.  
 Phellinodes, new species of, 310.  
 Phonolibes, new species of, 196.  
 Phrynobatrachus, new species of, 141.  
 Phyllomedusa, new species of, 186.  
 Phyllotis, new species of, 406.  
 Piletosoma, new species of, 2.  
 Pipefish, on the development of the pectoral girdle in the, 613.  
 Plæsius, new species of, 256.  
 Planorbis, new species of, 417.

- Plataspis, new species of, 87.  
 Platycephalus, new species of, 595.  
 Platylister, new species of, 257.  
 Pliodonta, definition of the new subordinal name, 104.  
 Plotia, new subspecies of, 419.  
 Plynteria, new species of, 515.  
 Podoctis, new species of, 71.  
 Polystigmata, characters of the new suborder, 220.  
 Porpoise, note on a white, 117.  
 Prometra, new species of, 37.  
 Prosopeas, new species of, 416.  
 Prosopis, new species of, 489.  
 Proutoscia, characters of the new genus, 286.  
 Psaliodes, new species of, 305.  
 Pselaphidæ, notes on New Zealand, 691.  
 Psen, new species of, 362.  
 Psenulus, new species of, 54, 363.  
 Pseudagenia, new species of, 51.  
 Psilozona, characters of the new genus, 157.  
 Psithyrus, new species of, 21.  
 Pteroglossus roraimæ, definition of the new specific name, 261.  
 Ptychoglossus, new species of, 421.  
 Pyralidæ, new species of, 1, 557.  
 Pyrinia, new species of, 232.  
 Pyrrhulina, new species of, 391.  
 Pyxicephalus, new species of, 140.  
 Racheospila, new species of, 289.  
 Radhades, characters of the new genus, 606.  
 Reduviolus, new species of, 201.  
 Regan, C. T., revision of the S.-American siluroid fishes of the genus *Corydoras*, 209; on the classification of the Blennioid fishes, 265; on two new eels from W. Africa, 323; on the anatomy and classification of the teleostean fishes of the order Lyomeri, 347; on the osteology and classification of the teleostean fishes of the order Apodes, 377; revision of the S.-American characid fishes of the genera *Chalceus* &c., 387; revision of the pœciliid fishes of the genera *Rivulus* &c., 494; on the anatomy and classification of the teleostean fishes of the order Discocephali, 634; on the Caristiidæ, 637; on sexual differences in the genus *Cynolebias*, 641.  
 Reithrodon, new subspecies of, 411.  
 Reptiles, new, 420; on the lower jaws of some, 573.  
 Rhagigaster, new species of, 533.  
 Rhinocoris, new species of, 196.  
 Rhopalum seychellense, definition of the new specific name, 375.  
 Rhynchocyon, new species of, 130.  
 Ricardo, Miss G., revision of the Asilidæ of Australasia, 142, 350.  
 Ridewood, Dr. W. G., on specimens of *Cephalodiscus nigrescens*, 550.  
 Rivulus, new species of, 502.  
 Robinson, H. C., on new mammals from the Johore Archipelago, 589.  
 Sagola, new species of, 622.  
 Sampson, Lt.-Col. W., on some new species of Ipidæ and Platypodidæ, 245.  
 Saropogon, notes on species of, 143.  
 Scapanulus, characters of the new genus, 396.  
 Scaphiodon, new species of, 596.  
 Schaus, W., on new heterocera from Costa Rica, 231, 286, 509.  
 Schwarz, E., on a new palm-civet from Timor, 131; notes on Malay tigers, 324.  
 Sciurus, new subspecies of, 592.  
 Scleroncyteris, characters of the new genus, 404.  
 Scott, Miss F., on a species of *Nymphon* from the N. Pacific, 206.  
 Scott, H., on the fauna of Bromeliaceæ, 424.  
 Scymnosuchus whaitsi, on the lower jaw of, 578.  
 Selenometra, new species of, 32.  
 Semiothisa, new species of, 231.  
 Septaria, new species of, 419.  
 Shelford, R., on a new bromeliadicolous species of Blattidæ, 431.  
 Silvius, new species of, 226.  
 Sitades, characters of the new genus, 608.  
 Small, W., report on Annelida Polychæta from the North Sea, 165.  
 Sorex, new species of, 398.  
 Spheg, new species of, 56, 369.  
 Stather, J. W., on shelly clay from the Dogger Bank, 164.  
 Stromatoporoidea, on the, 341, 446.  
 Summers, Miss S. L. M., on blood-sucking diptera from Port Darwin, 222.

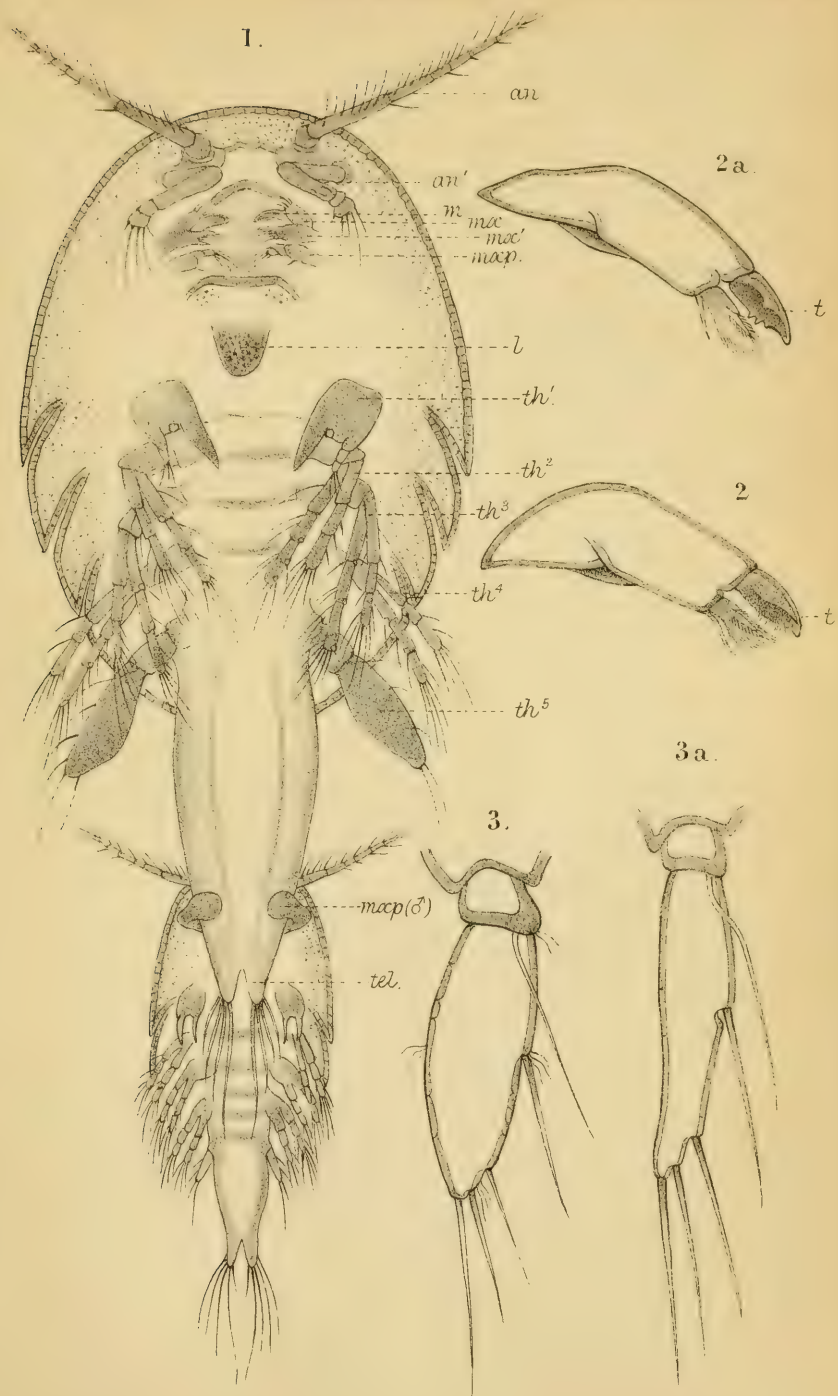
- Sylepta*, new species of, 3.  
*Syngnathus acus*, on the development of the pectoral girdle in, 613.  
*Syngropia*, characters of the new genus, 18.  
*Tabanus*, new species of, 224, 240.  
*Tachyphyle*, new species of, 288.  
*Talitrus*, new species of, 133.  
*Tarebia*, new subspecies of, 419.  
 Teleostean fishes, on the anatomy and classification of, of the order *Lyomeri*, 347, of the order *Apodes*, 377.  
*Teretriosoma*, new species of, 255.  
*Terpnosia*, new species of, 439.  
*Tetrapedia*, new species of, 30.  
*Therina*, new species of, 235.  
 Thomas, O., on mammals from the Ja River, 41; on small mammals from S. America, 44; on a new vespertilionine bat from Angola, 204; on two new species of *Nasua*, 228; on two new W.-African mammals, 280; on small mammals from the Tsin-ling Mountains, 395; on new bats and rodents from S. America, 403; on two new races of mungoose, 588; on new *Centronycteris* and *Otenomys* from S. America, 638.  
 Thomson, Dr. J. S., on living gorgonias occurring in the English Channel, 479.  
*Thryothorus*, new subspecies of, 262.  
*Thynnoides*, new species of, 539.  
*Thynnoturmeria*, new species of, 49.  
*Thynnus*, new species of, 544.  
*Thyriodes*, new species of, 510.  
*Thysanoptera*, on the classification of the, 220.  
*Tilapia*, new species of, 138.  
*Tragelaphodes*, new species of, 200.  
*Trigona*, new species of, 311.  
*Trochomorpha*, new species of, 414.  
*Tropidurus*, new species of, 420.  
*Trypanæus*, note on the genus, 250.  
*Trypeticus*, note on the genus, 250.  
 Turner, R. E., notes on fossorial hymenoptera, 48, 361, 533.  
*Urabunana*, new species of, 440.  
*Vespola*, new species of, 509.  
*Vima*, characters of the new genus, 66.  
*Vivipara*, new subspecies of, 418.  
*Vulturinus*, new species of, 445.  
 Walker, A. O., on *Apherusa jurinei*, 600.  
 Watson, D. M. S., on some reptilian lower jaws, 573.  
*Xanthospilopteryx*, new species of, 609.  
*Xesta*, new species of, 412.  
*Xyleborus*, new species of, 245.  
*Xylocopa*, new subspecies of, 491.  
*Zalmoxis*, new species of, 65.  
*Zapus*, new subspecies of, 402.  
*Zaspilothynnus*, new species of, 543.  
*Zoyphium*, new species of, 59.  
 Zugmayer, Dr. E., on new fishes from Baluchistan, 595.

END OF THE TENTH VOLUME.



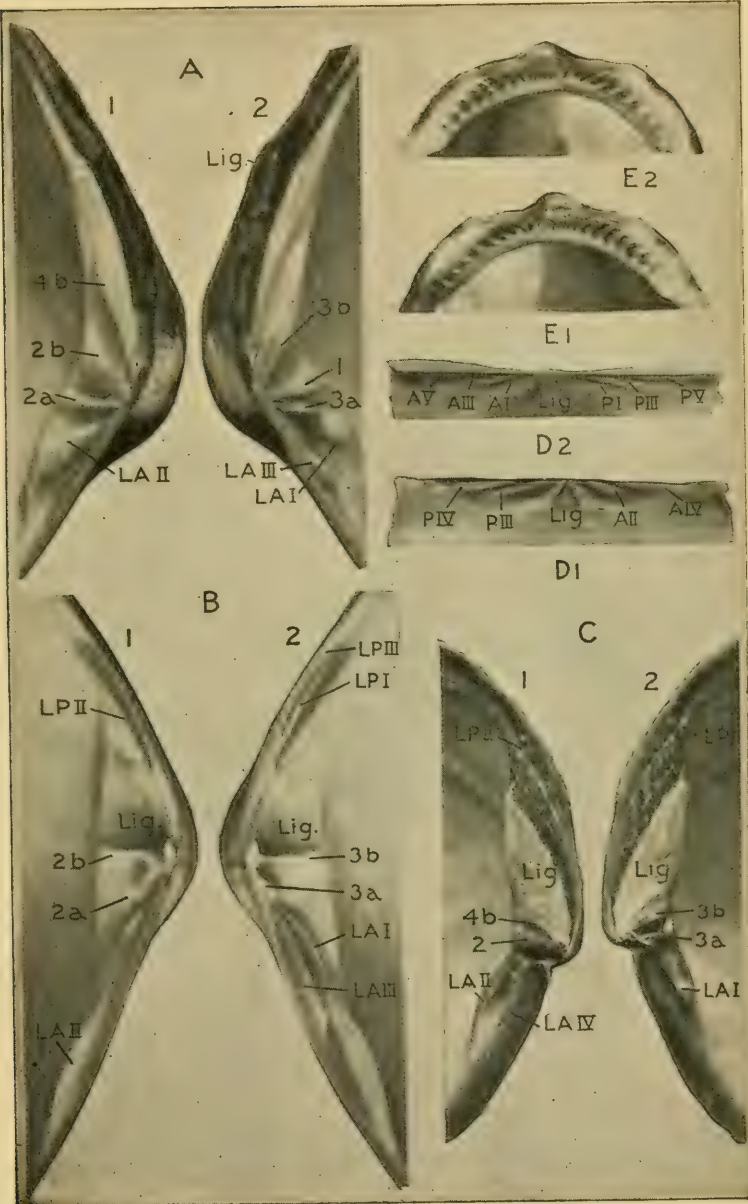










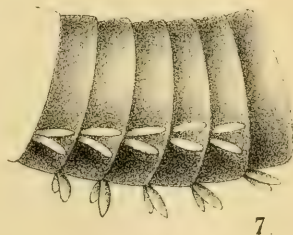
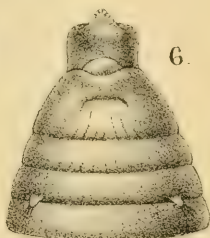
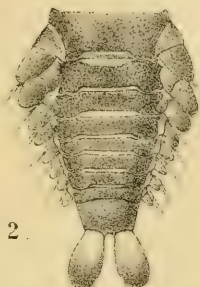












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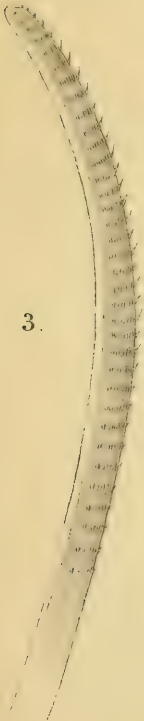
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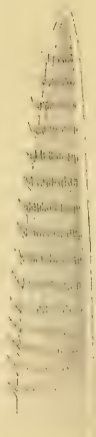




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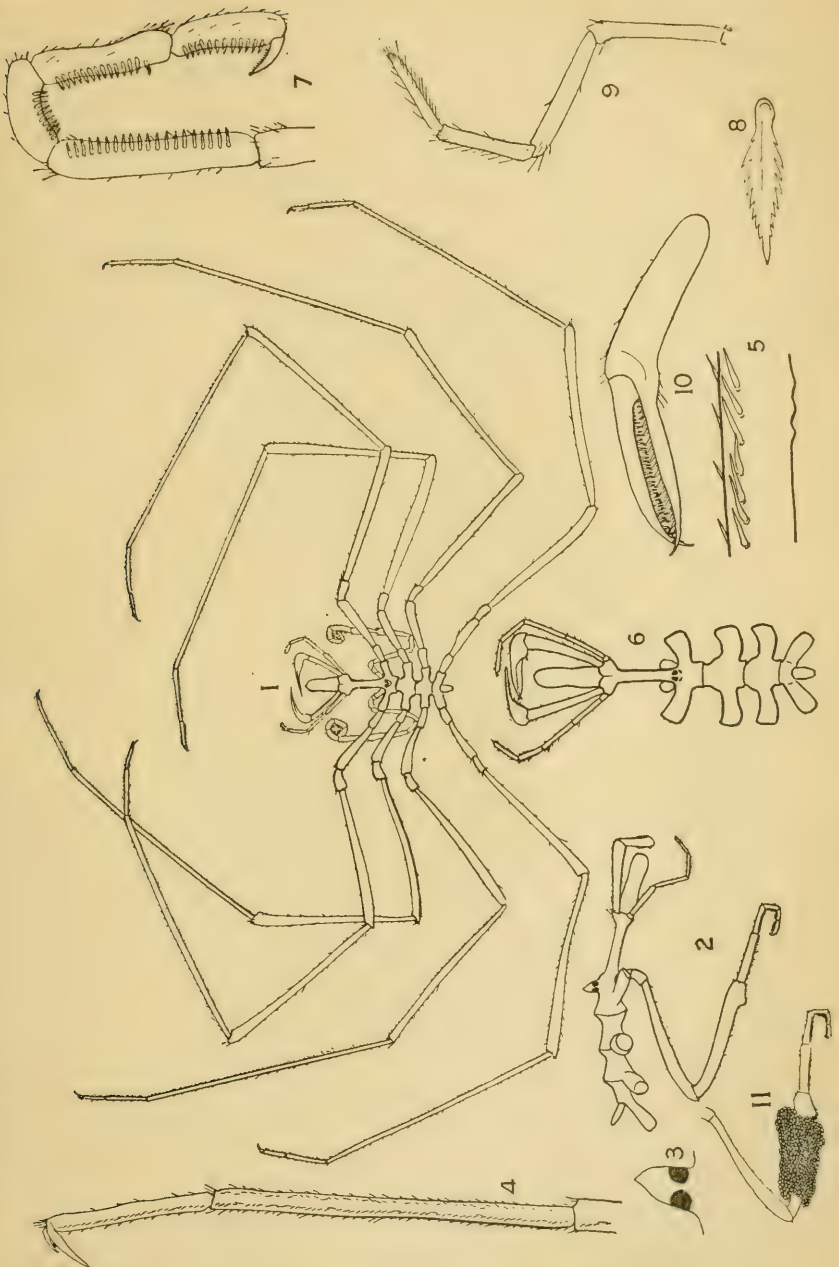
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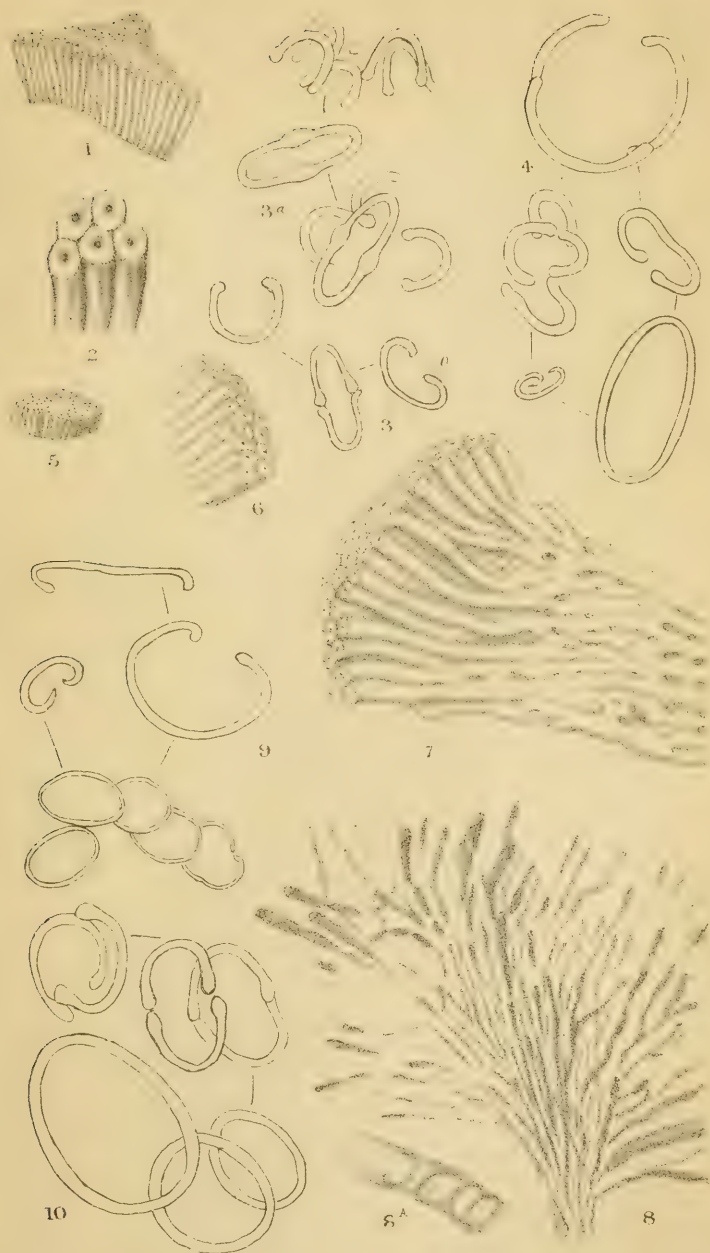




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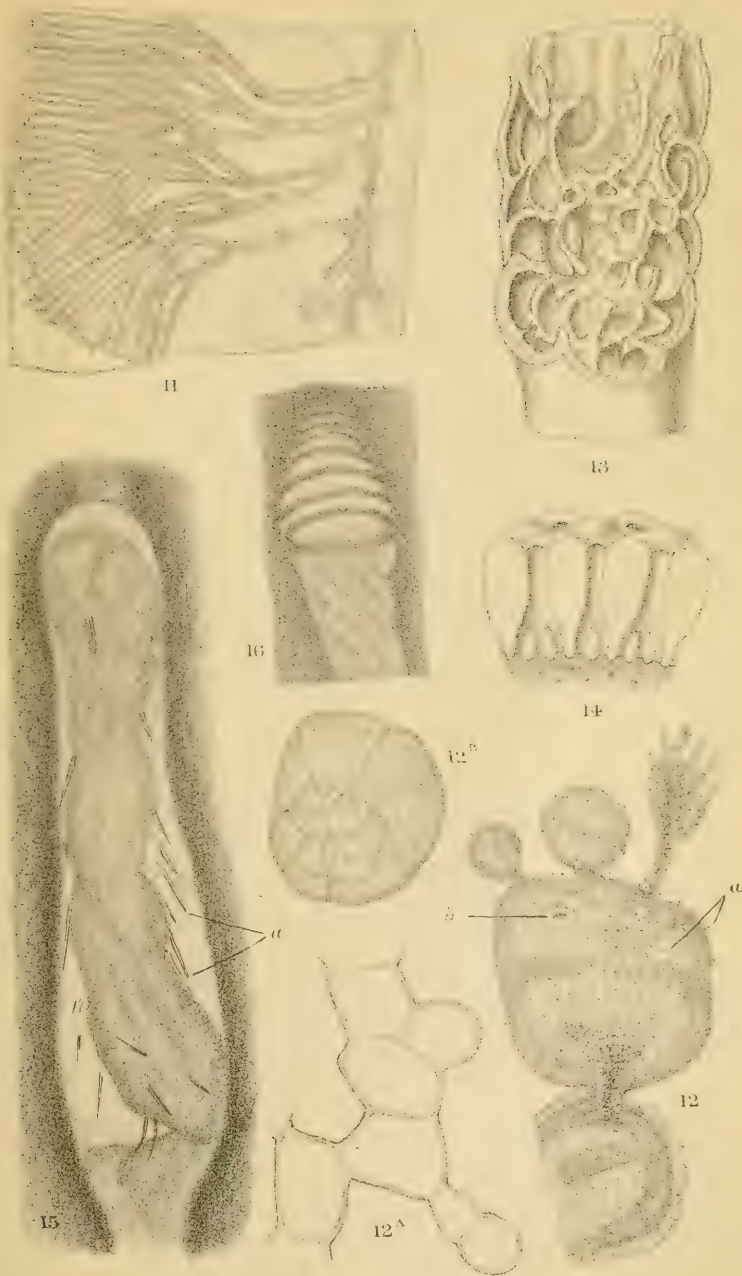
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1-3<sup>a</sup>. STROMATOPORA. 4. POLYTREMA.

5-10. EOZOON.







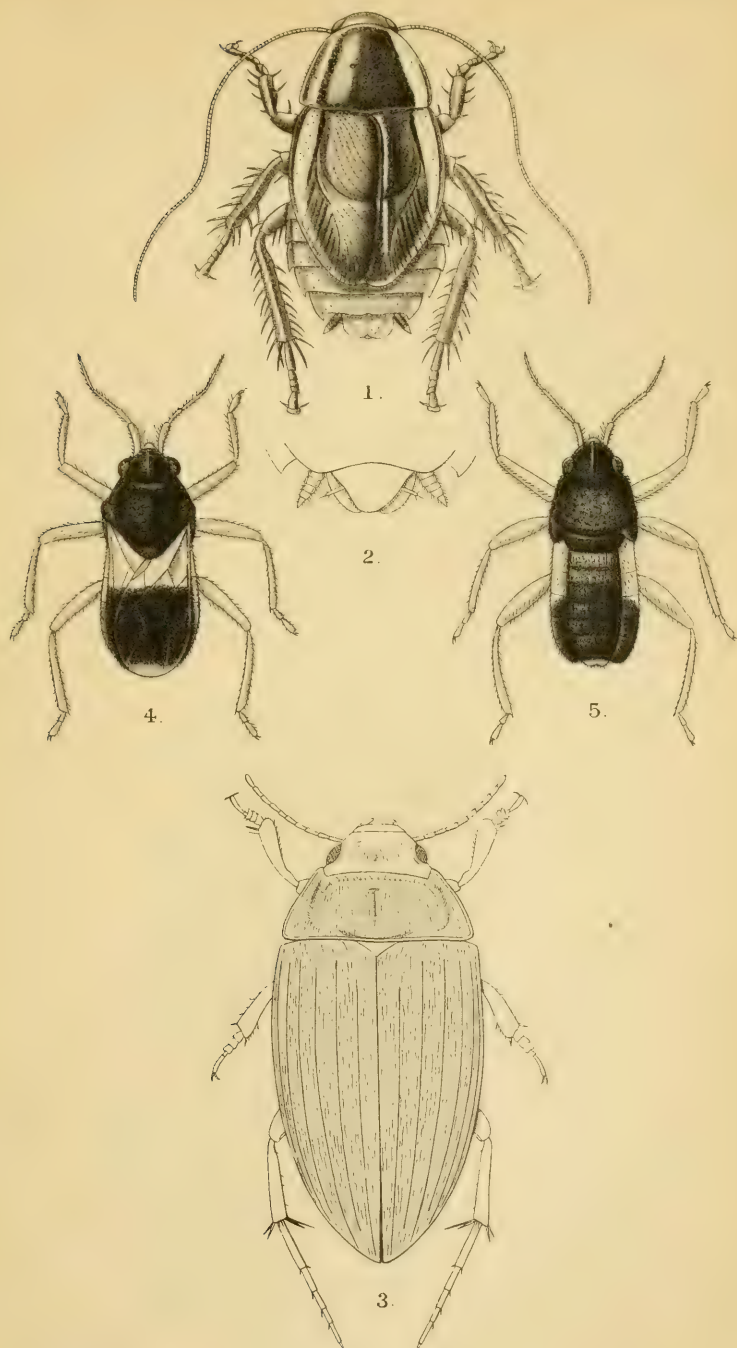
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1



2

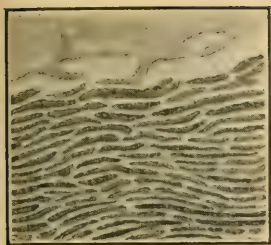


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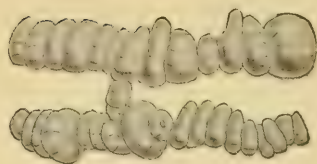


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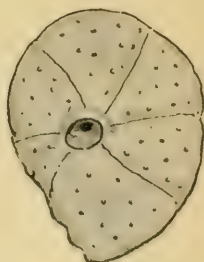




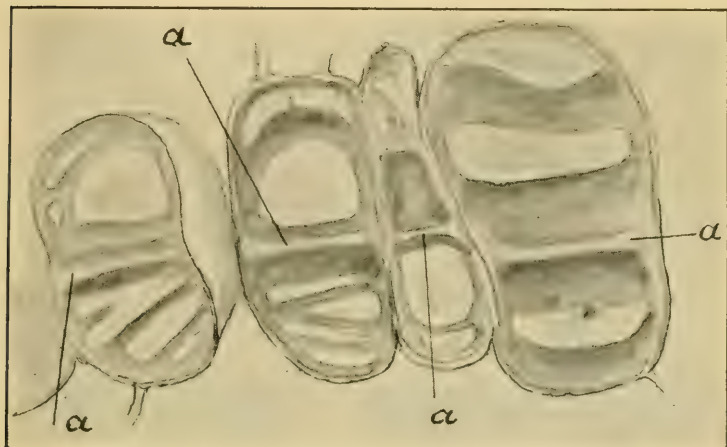
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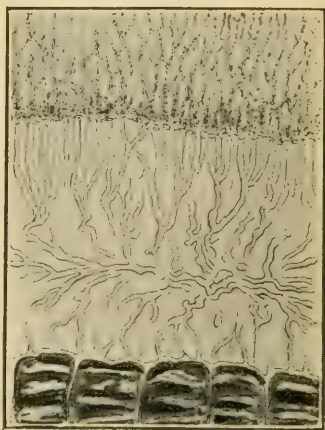
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8 A



8 B



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3.



4.



2



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# CONTENTS OF NUMBER 60.—*Eighth Series.*

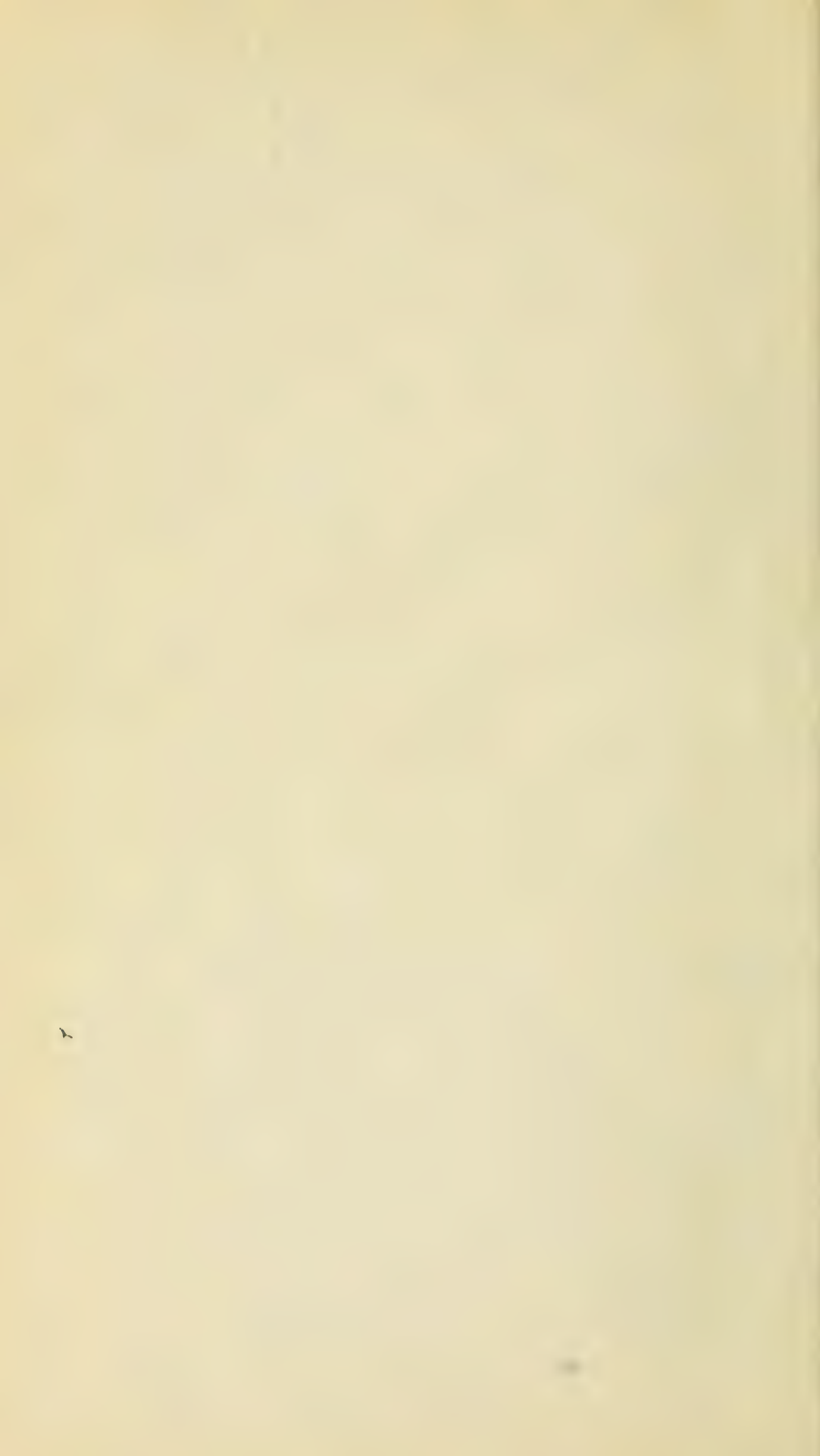
LXVI. Descriptions of new Species of <i>Pyralidæ</i> of the Subfamily <i>Pyraustince</i> . By Sir GEORGE F. HAMPSON, Bart., F.Z.S., &c. ....	55
LXVII. On some Reptilian Lower Jaws. By D. M. S. WATSON, M.Sc. ....	56
LXVIII. Two new Races of Mongoose. By OLDFIELD THOMAS ..	58
LXIX. On new Mammals from the Islands of the Johore Archipelago, South China Sea. By HERBERT C. ROBINSON, C.M.Z.S. ....	58
LXX. Eight new Fishes from Baluchistan. By Dr. ERICH ZUGMAYER, of the Zoological Museum, Munich .....	59
LXXI. <i>Apherusa jurinei</i> (M.-Edw.). By ALFRED O. WALKER, F.L.S., F.Z.S. ....	60
LXXII. Descriptions of Two new Fishes from the Nile System. By G. A. BOULENGER, F.R.S. ....	60
LXXIII. Rhynchotal Notes. By W. L. DISTANT .....	60
LXXIV. Descriptions of new African <i>Agaristidæ</i> in the British Museum. By Sir GEORGE F. HAMPSON, Bart. ....	60
LXXV. Two new Mongooses from Somaliland. By R. E. DRAKE-BROCKMAN, M.R.C.S., L.R.C.P., F.Z.S. ....	61
LXXVI. On the Development of the Pectoral Girdle in the Pipefish ( <i>Syngnathus acus</i> ). By T. P. BUIST, M.A., B.Sc., Gatty Marine Laboratory, University of St. Andrews. (Plate XIII.) .....	61
LXXVII. Notes on some New Zealand <i>Pselaphidæ</i> in the British Museum, with Descriptions of new Species of the Genus <i>Sagola</i> . By Major T. BROWN, F.E.S. ....	62
LXXVIII. The Anatomy and Classification of the Teleostean Fishes of the Order Discocephali. By C. TATE REGAN, M.A. ....	63
LXXIX. The <i>Caristiidæ</i> , a Family of Berycomorphous Fishes. By C. TATE REGAN, M.A. ....	63
LXXX. New <i>Centronycteris</i> and <i>Otenomys</i> from S. America. By OLDFIELD THOMAS .....	63
LXXXI. A new <i>Cynopterus</i> from Bornco. By KNUD ANDERSEN ..	64
LXXXII. Sexual Differences in the Pœciliid Fishes of the Genus <i>Cynolebias</i> . By C. TATE REGAN, M.A. ....	64
Index .....	64

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912

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